MITSUBISHI ELECTRIC

Mitsubishi Programmable Controller

MELSEC iQ-R series

MELSEC iQ-R Simple Motion Module User's Manual (Startup)

RD77MS2
RD77MS4
RD77MS8
RD77MS16

SAFETY PRECAUTIONS

(Read these precautions before using this product.)
Before using this product, please read this manual and the relevant manuals carefully and pay full attention to safety to handle the product correctly.
The precautions given in this manual are concerned with this product only. Refer to the user's manual of the CPU module to use for a description of the PLC system safety precautions.
In this manual, the safety precautions are classified into two levels: "⚠WARNING" and "⚠CAUTION".

⚠ **WARNING**	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ **CAUTION**	Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.

Under some circumstances, failure to observe the precautions given under "⚠CAUTION" may lead to serious consequences.
Observe the precautions of both levels because they are important for personal and system safety.
Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

[Design Precautions]

⚠WARNING

- Configure safety circuits external to the programmable controller to ensure that the entire system operates safely even when a fault occurs in the external power supply or the programmable controller. Failure to do so may result in an accident due to an incorrect output or malfunction.
  (1) Configure external safety circuits, such as an emergency stop circuit, protection circuit, and protective interlock circuit for forward/reverse operation or upper/lower limit positioning.
  (2) The programmable controller stops its operation upon detection of the following status, and the output status of the system will be as shown below.
    • Turned off if the overcurrent or overvoltage protection of the power supply module is activated.
    • Held or turned off according to the parameter setting if the self-diagnostic function of the CPU module detects an error such as a watchdog timer error.
  (3) Also, all outputs may be turned on if an error occurs in a part, such as an I/O control part, where the CPU module cannot detect any error. To ensure safety operation in such a case, provide a safety mechanism or a fail-safe circuit external to the programmable controller. For a fail-safe circuit example, refer to the user's manual of the CPU module to use.
  (4) Outputs may remain on or off due to a failure of a component such as a relay and transistor in an output circuit. Configure an external circuit for monitoring output signals that could cause a serious accident.
- In an output circuit, when a load current exceeding the rated current or an overcurrent caused by a load short-circuit flows for a long time, it may cause smoke and fire. To prevent this, configure an external safety circuit, such as a fuse.
- Configure a circuit so that the programmable controller is turned on first and then the external power supply. If the external power supply is turned on first, an accident may occur due to an incorrect output or malfunction.
- For the operating status of each station after a communication failure, refer to manuals relevant to the network. Incorrect output or malfunction due to a communication failure may result in an accident.

⚠WARNING

- When connecting an external device with a CPU module or intelligent function module to modify data of a running programmable controller, configure an interlock circuit in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents.
- Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module in case of a communication failure.
- Do not write any data to the "system area" and "write-protect area" of the buffer memory in the module. Also, do not use any "use prohibited" signals as an output signal from the CPU module to each module. Doing so may cause malfunction of the programmable controller system. For the "system area", "write-protect area", and the "use prohibited" signals, refer to the user's manual for the module used.
- If a communication cable is disconnected, the network may be unstable, resulting in a communication failure of multiple stations. Configure an interlock circuit in the program to ensure that the entire system will always operate safely even if communications fail. Failure to do so may result in an accident due to an incorrect output or malfunction.
- To maintain the safety of the programmable controller system against unauthorized access from external devices via the network, take appropriate measures. To maintain the safety against unauthorized access via the Internet, take measures such as installing a firewall.
- Configure safety circuits external to the programmable controller to ensure that the entire system operates safely even when a fault occurs in the external power supply or the programmable controller. Failure to do so may result in an accident due to an incorrect output or malfunction.
  (1) Machine home position return is controlled by two kinds of data: a home position return direction and a home position return speed. Deceleration starts when the near-point dog signal turns on. If an incorrect home position return direction is set, motion control may continue without deceleration. To prevent machine damage caused by this, configure an interlock circuit external to the programmable controller.
  (2) When the module detects an error, the motion slows down and stops or the motion suddenly stops, depending on the stop group setting in parameter. Set the parameter to meet the specifications of a positioning control system. In addition, set the home position return parameter and positioning data within the specified setting range.
  (3) Outputs may remain on or off, or become undefined due to a failure of a component such as an insulation element and transistor in an output circuit, where the module cannot detect any error. In a system that the incorrect output could cause a serious accident, configure an external circuit for monitoring output signals.
- If safety standards (ex., robot safety rules, etc.,) apply to the system using the module, servo amplifier and servomotor, make sure that the safety standards are satisfied.
- Construct a safety circuit externally of the module or servo amplifier if the abnormal operation of the module or servo amplifier differs from the safety directive operation in the system.
- Do not remove the SSCNETⅢ cable while turning on the control circuit power supply of Multiple CPU system and servo amplifier. Do not see directly the light generated from SSCNETⅢ connector of the module or servo amplifier and the end of SSCNETⅢ cable. When the light gets into eyes, you may feel something wrong with eyes. (The light source of SSCNETⅢ complies with class1 defined in JISC6802 or IEC60825-1.)

[Design Precautions]

⚠CAUTION

- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 100 mm or more between them. Failure to do so may result in malfunction due to noise.
- During control of an inductive load such as a lamp, heater, or solenoid valve, a large current (approximately ten times greater than normal) may flow when the output is turned from off to on. Therefore, use a module that has a sufficient current rating.
- After the CPU module is powered on or is reset, the time taken to enter the RUN status varies depending on the system configuration, parameter settings, and/or program size. Design circuits so that the entire system will always operate safely, regardless of the time.
- Do not power off the programmable controller or do not reset the CPU module during the setting registration. Doing so will make the data in the flash ROM undefined. The data need to be set in the buffer memory and to be written to the flash ROM again. Doing so may cause malfunction or failure of the module.
- Reset the CPU module after changing the parameters. Failure to do so may cause malfunction because the previous parameter settings remain in the module.
- When changing the operating status of the CPU module from external devices (such as remote RUN/STOP), select "Do Not Open by Program" for "Opening Method" in the module parameters. If "Open by Program" is selected, an execution of remote STOP causes the communication line to close. Consequently, the CPU module cannot reopen the communication line, and external devices cannot execute the remote RUN.

[Installation Precautions]

⚠WARNING

- Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may result in electric shock or cause the module to fail or malfunction.

[Installation Precautions]

⚠CAUTION

- Use the programmable controller in an environment that meets the general specifications in the manual "Safety Guidelines" included in the base unit. Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
- To mount a module, place the concave part(s) located at the bottom onto the guide(s) of the base unit, and push in the module until the hook(s) located at the top snaps into place. Incorrect mounting may cause malfunction, failure, or drop of the module.
- When using the programmable controller in an environment of frequent vibrations, fix the module with a screw.
- Tighten the screws within the specified torque range. Undertightening can cause drop of the screw, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- When using an extension cable, connect it to the extension cable connector of the base unit securely. Check the connection for looseness. Poor contact may cause incorrect input or output.
- When using an SD memory card, fully insert it into the memory card slot. Check that it is inserted completely. Poor contact may cause malfunction.
- Securely insert an extended SRAM cassette into the cassette connector of a CPU module. After insertion, close the cassette cover and check that the cassette is inserted completely. Poor contact may cause malfunction.
- Do not directly touch any conductive parts and electronic components of the module, SD memory card, extended SRAM cassette, or connector. Doing so may cause malfunction or failure of the module.

[Wiring Precautions]

⚠WARNING

- Shut off the external power supply (all phases) used in the system before installation and wiring. Failure to do so may result in electric shock or damage to the product.
- After installation and wiring, attach the included terminal cover to the module before turning it on for operation. Failure to do so may result in electric shock.

[Wiring Precautions]

⚠CAUTION

- Individually ground the FG and LG terminals of the programmable controller with a ground resistance of 100 ohm or less. Failure to do so may result in electric shock or malfunction.
- Use applicable solderless terminals and tighten them within the specified torque range. If any spade solderless terminal is used, it may be disconnected when the terminal screw comes loose, resulting in failure.
- Check the rated voltage and signal layout before wiring to the module, and connect the cables correctly. Connecting a power supply with a different voltage rating or incorrect wiring may cause fire or failure.
- Connectors for external devices or coaxial cables must be crimped or pressed with the tool specified by the manufacturer, or must be correctly soldered. Incomplete connections may cause short circuit, fire, or malfunction.
- Securely connect the connector to the module. Poor contact may cause malfunction.
- Do not install the control lines or communication cables together with the main circuit lines or power cables. Keep a distance of 100 mm or more between them. Failure to do so may result in malfunction due to noise.
- Place the cables in a duct or clamp them. If not, dangling cable may swing or inadvertently be pulled, resulting in damage to the module or cables or malfunction due to poor contact. Do not clamp the extension cables with the jacket stripped.
- Check the interface type and correctly connect the cable. Incorrect wiring (connecting the cable to an incorrect interface) may cause failure of the module and external device.
- Tighten the terminal screws or connector screws within the specified torque range. Undertightening can cause drop of the screw, short circuit, fire, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, fire, or malfunction.
- When disconnecting the cable from the module, do not pull the cable by the cable part. For the cable with connector, hold the connector part of the cable. For the cable connected to the terminal block, loosen the terminal screw. Pulling the cable connected to the module may result in malfunction or damage to the module or cable.
- Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.
- A protective film is attached to the top of the module to prevent foreign matter, such as wire chips, from entering the module during wiring. Do not remove the film during wiring. Remove it for heat dissipation before system operation.
- Mitsubishi programmable controllers must be installed in control panels. Connect the main power supply to the power supply module in the control panel through a relay terminal block. Wiring and replacement of a power supply module must be performed by qualified maintenance personnel with knowledge of protection against electric shock. For wiring, refer to the MELSEC iQ-R Module Configuration Manual.
- For Ethernet cables to be used in the system, select the ones that meet the specifications in the MELSEC iQ-R Ethernet/CC-Link IE User's Manual (Startup). If not, normal data transmission is not guaranteed.

[Startup and Maintenance Precautions]

⚠WARNING

- Do not touch any terminal while power is on. Doing so will cause electric shock or malfunction.
- Correctly connect the battery connector. Do not charge, disassemble, heat, short-circuit, solder, or throw the battery into the fire. Also, do not expose it to liquid or strong shock. Doing so may cause the battery to generate heat, explode, ignite, or leak, resulting in injury or fire.
- Shut off the external power supply (all phases) used in the system before cleaning the module or retightening the terminal screws, connector screws, or module fixing screws. Failure to do so may result in electric shock or cause the module to fail or malfunction.

[Startup and Maintenance Precautions]

⚠CAUTION

- When connecting an external device with a CPU module or intelligent function module to modify data of a running programmable controller, configure an interlock circuit in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents.
- Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module in case of a communication failure.
- Do not disassemble or modify the modules. Doing so may cause failure, malfunction, injury, or a fire.
- Use any radio communication device such as a cellular phone or PHS (Personal Handyphone System) more than 25 cm away in all directions from the programmable controller. Failure to do so may cause malfunction.
- Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may cause the module to fail or malfunction.
- Tighten the screws within the specified torque range. Undertightening can cause drop of the component or wire, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- After the first use of the product, do not mount/remove the module to/from the base unit, and the terminal block to/from the module, and do not insert/remove the extended SRAM cassette to/from the CPU module more than 50 times (IEC 61131-2 compliant) respectively. Exceeding the limit of 50 times may cause malfunction.
- After the first use of the product, do not insert/remove the SD memory card to/from the CPU module more than 500 times. Exceeding the limit may cause malfunction.
- Do not touch the metal terminals on the back side of the SD memory card. Doing so may cause malfunction or failure.
- Do not touch the integrated circuits on the circuit board of an extended SRAM cassette. Doing so may cause malfunction or failure.
- Do not drop or apply shock to the battery to be installed in the module. Doing so may damage the battery, causing the battery fluid to leak inside the battery. If the battery is dropped or any shock is applied to it, dispose of it without using.

⚠CAUTION

- Startup and maintenance of a control panel must be performed by qualified maintenance personnel with knowledge of protection against electric shock. Lock the control panel so that only qualified maintenance personnel can operate it.
- Before handling the module, touch a conducting object such as a grounded metal to discharge the static electricity from the human body. Failure to do so may cause the module to fail or malfunction.
- Before testing the operation, set a low speed value for the speed limit parameter so that the operation can be stopped immediately upon occurrence of a hazardous condition.
- Confirm and adjust the program and each parameter before operation. Unpredictable movements may occur depending on the machine.
- When using the absolute position system function, on starting up, and when the module or absolute value motor has been replaced, always perform a home position return.
- Before starting the operation, confirm the brake function.
- Do not perform a megger test (insulation resistance measurement) during inspection.
- After maintenance and inspections are completed, confirm that the position detection of the absolute position detection function is correct.
- Lock the control panel and prevent access to those who are not certified to handle or install electric equipment.

[Operating Precautions]

⚠CAUTION

- When changing data and operating status, and modifying program of the running programmable controller from an external device such as a personal computer connected to an intelligent function module, read relevant manuals carefully and ensure the safety before operation. Incorrect change or modification may cause system malfunction, damage to the machines, or accidents.
- Do not power off the programmable controller or reset the CPU module while the setting values in the buffer memory are being written to the flash ROM in the module. Doing so will make the data in the flash ROM undefined. The values need to be set in the buffer memory and written to the flash ROM again. Doing so also can cause malfunction or failure of the module.
- Note that when the reference axis speed is specified for interpolation operation, the speed of the partner axis (2nd, 3rd, or 4th axis) may exceed the speed limit value.
- Do not go near the machine during test operations or during operations such as teaching. Doing so may lead to injuries.

[Disposal Precautions]

⚠CAUTION

- When disposing of this product, treat it as industrial waste.
- When disposing of batteries, separate them from other wastes according to the local regulations. For details on battery regulations in EU member states, refer to the MELSEC iQ-R Module Configuration Manual.

[Transportation Precautions]

⚠CAUTION

- When transporting lithium batteries, follow the transportation regulations. For details on the regulated models, refer to the MELSEC iQ-R Module Configuration Manual.
- The halogens (such as fluorine, chlorine, bromine, and iodine), which are contained in a fumigant used for disinfection and pest control of wood packaging materials, may cause failure of the product. Prevent the entry of fumigant residues into the product or consider other methods (such as heat treatment) instead of fumigation. The disinfection and pest control measures must be applied to unprocessed raw wood.

CONDITIONS OF USE FOR THE PRODUCT

(1) Mitsubishi programmable controller ("the PRODUCT") shall be used in conditions;
i) where any problem, fault or failure occurring in the PRODUCT, if any, shall not lead to any major or serious accident; and
ii) where the backup and fail-safe function are systematically or automatically provided outside of the PRODUCT for the case of any problem, fault or failure occurring in the PRODUCT.

(2) The PRODUCT has been designed and manufactured for the purpose of being used in general industries.
MITSUBISHI SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY the PRODUCT THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN MITSUBISHI'S USER, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the PRODUCT.
("Prohibited Application")
Prohibited Applications include, but not limited to, the use of the PRODUCT in;
- Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the PRODUCT.
- Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.
- Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.

Notwithstanding the above, restrictions Mitsubishi may in its sole discretion, authorize use of the PRODUCT in one or more of the Prohibited Applications, provided that the usage of the PRODUCT is limited only for the specific applications agreed to by Mitsubishi and provided further that no special quality assurance or fail-safe, redundant or other safety features which exceed the general specifications of the PRODUCTs are required. For details, please contact the Mitsubishi representative in your region.

INTRODUCTION

Thank you for purchasing the Mitsubishi MELSEC iQ-R series programmable controllers.
This manual describes the specifications, procedures before operation and wiring of the relevant products listed below. Before using this product, please read this manual and the relevant manuals carefully and develop familiarity with the functions and performance of the MELSEC iQ-R series programmable controller to handle the product correctly.
When applying the program examples provided in this manual to an actual system, ensure the applicability and confirm that it will not cause system control problems.
Please make sure that the end users read this manual.

Relevant products

RD77MS2, RD77MS4, RD77MS8, RD77MS16

Point

In this manual, buffer memories are classified using the following symbols. Each area name can represent the buffer memories corresponding to each axis.
- [Pr.**]: Symbols indicating positioning parameter or home position return parameter items
- [Da.**]: Symbols indicating positioning data or block start data items
- [Md.**]: Symbols indicating monitor data items
- [Cd.**]: Symbols indicating control data items

COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES

Method of ensuring compliance

To ensure that Mitsubishi programmable controllers maintain EMC and Low Voltage Directives when incorporated into other machinery or equipment, certain measures may be necessary. Please refer to one of the following manuals.

📖MELSEC iQ-R Module Configuration Manual

📖Safety Guidelines (This manual is included with the base unit.)

The CE mark on the side of the programmable controller indicates compliance with EMC and Low Voltage Directives.

Additional measures

To ensure that this product maintains EMC and Low Voltage Directives, please refer to one of the following manuals.

📖MELSEC iQ-R Module Configuration Manual

📖Safety Guidelines (This manual is included with the base unit.)

CONTENTS

RELEVANT MANUALS

Manual name [manual number]	Description	Available form
MELSEC iQ-R Simple Motion Module User's Manual (Startup) [IB-0300245] (This manual)	Specifications, procedures before operation, system configuration, wiring, and operation examples of the Simple Motion module	Print book
		e-Manual EPUB PDF
MELSEC iQ-R Simple Motion Module User's Manual (Application) [IB-0300247]	Functions, input/output signals, buffer memories, parameter settings, programming, and troubleshooting of the Simple Motion module	Print book
		e-Manual EPUB PDF
MELSEC iQ-R Simple Motion Module User's Manual (Advanced Synchronous Control) [IB-0300249]	Functions and programming for the synchronous control of the Simple Motion module	Print book
		e-Manual EPUB PDF

This manual does not include detailed information on the followings:

- General specifications
- Available CPU modules and the number of mountable modules
- Installation environment and installation position
- Specifications and precautions of the inter-module synchronization function

For details, refer to the following.

MELSEC iQ-R Module Configuration Manual

Point

e-Manual refers to the Mitsubishi FA electronic book manuals that can be browsed using a dedicated tool.

e-Manual has the following features:

- Required information can be cross-searched in multiple manuals.
- Other manuals can be accessed from the links in the manual.
- The hardware specifications of each part can be found from the product figures.
- Pages that users often browse can be bookmarked.

TERMS

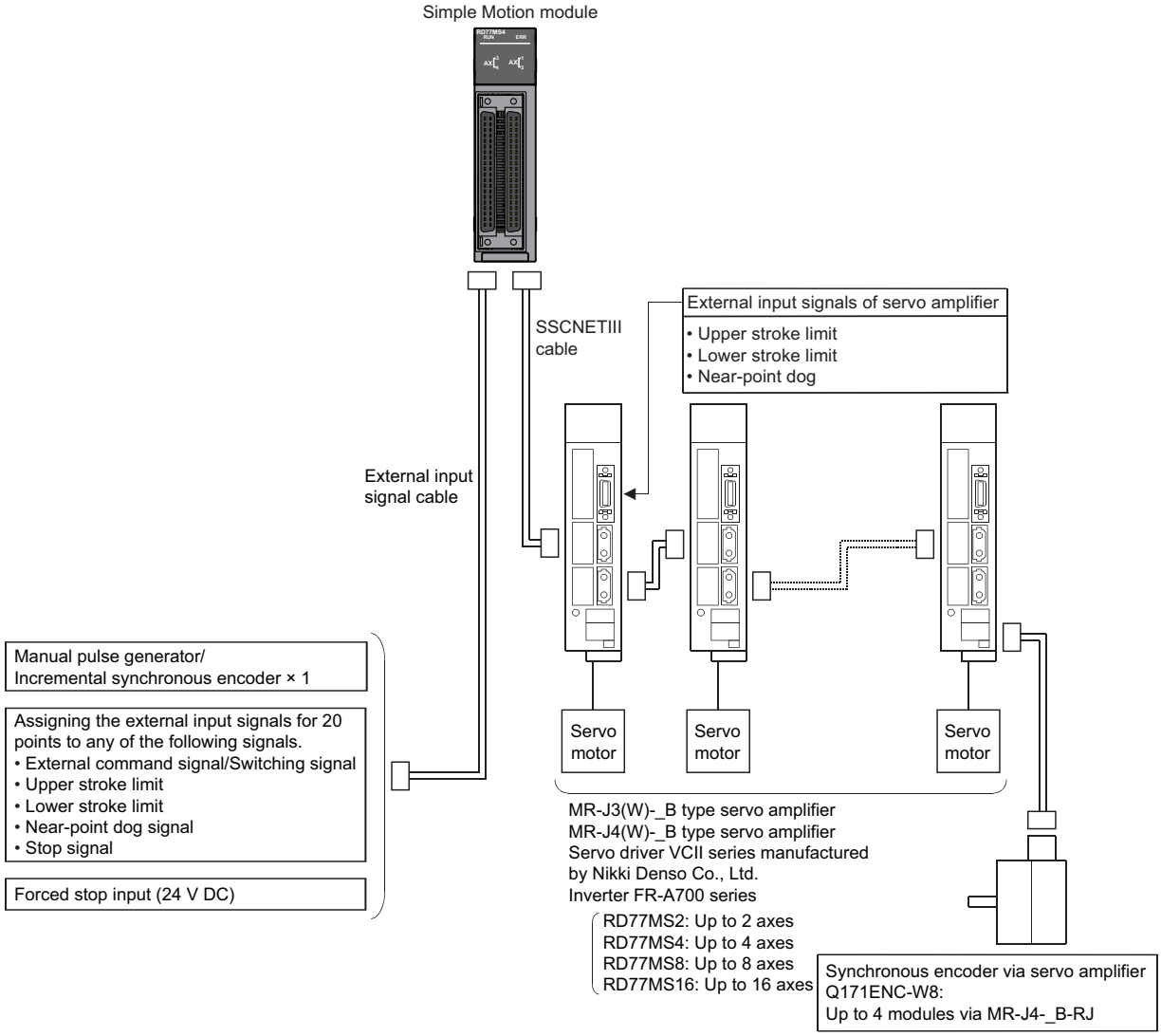
Unless otherwise specified, this manual uses the following terms.

Term	Description
CPU module	Abbreviation for the MELSEC iQ-R series CPU module.
Simple Motion module	Abbreviation for the MELSEC iQ-R series Simple Motion module.
RD77MS	Another term for the MELSEC iQ-R series Simple Motion module.
Servo amplifier	Abbreviation for SSCNETⅢ/H and SSCNETⅢ compatible servo amplifier.
MR-J4(W)-B	MR-J4-_B/MR-J4W_-_B Servo amplifier series
MR-J3(W)-B	MR-J3-_B/MR-J3W-_B Servo amplifier series
Engineering tool	Generic term for GX Works3 and MR Configurator2.
GX Works3	Product name of the software package for the MELSEC programmable controllers.
MR Configurator2	Product name of the setup software for the servo amplifier (Version 1.27D or later).
Intelligent function module	A MELSEC iQ-R series module that has functions other than input or output, such as A/D converter module and D/A converter module
Manual pulse generator	Abbreviation for manual pulse generator (prepared by user).
SSCNETⅢ/H[*1]	High speed synchronous communication network between RD77MS and servo amplifier.
SSCNETⅢ[*1]	
SSCNETⅢ(/H)	Generic term for SSCNETⅢ/H, SSCNETⅢ.
Servo network	
2-axis module	Generic term for RD77MS2.
4-axis module	Generic term for RD77MS4.
8-axis module	Generic term for RD77MS8.
16-axis module	Generic term for RD77MS16.

*1 SSCNET: Servo System Controller NETwork

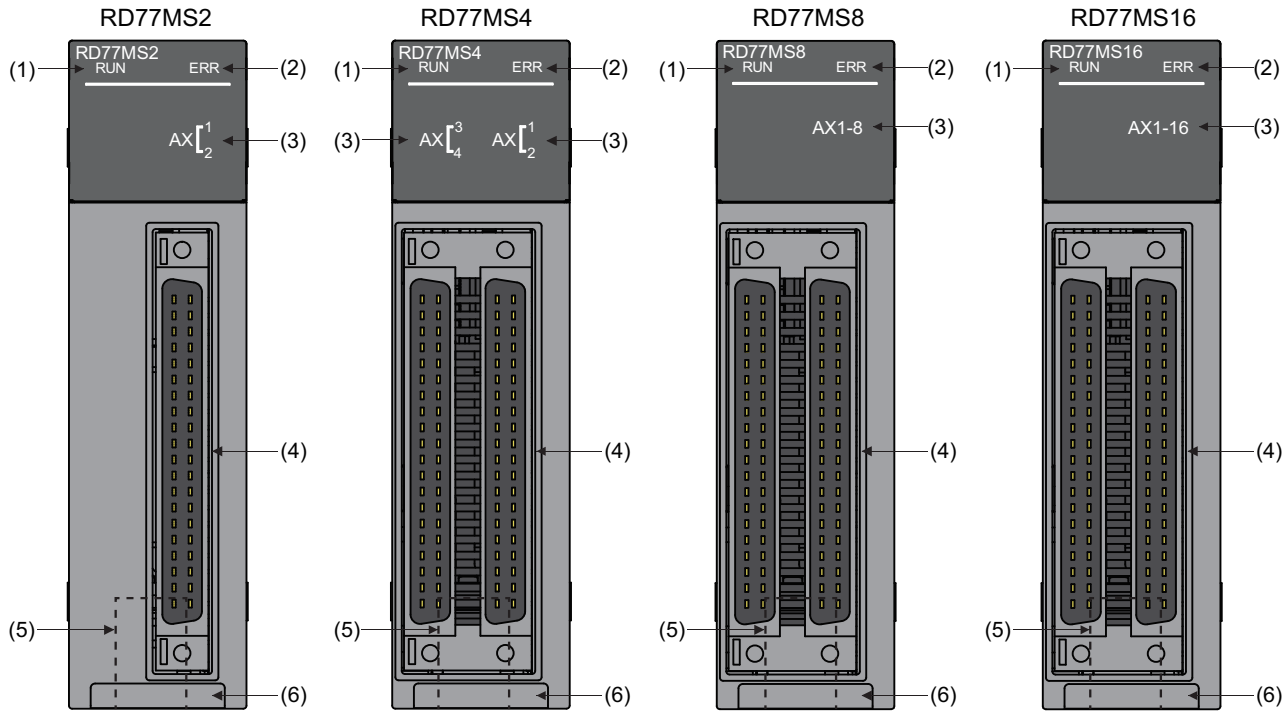
PERIPHERALS

The following figure shows the peripherals when the RD77MS is used.



1 PART NAMES

This chapter describes the part names of the Simple Motion module.



No.	Name	Description
(1)	RUN LED	For details, refer to the following. ☞ Page 17 LED Display Specifications
(2)	ERR LED	
(3)	Axis display LED	
(4)	External input connection connector	Connects to a mechanical system input, manual pulse generator/incremental synchronous encoder, or forced stop input. For the signal layout, refer to the following. ☞ Page 20 Specifications of Interfaces with External Devices
(5)	SSCNETIII cable connector	Connects to a servo amplifier.
(6)	Serial number marking	Shows the serial number printed on the rating plate.

1.1 LED Display Specifications

This section lists LED display specifications.

☐: OFF, ■: ON, ●: Flashing

RD77MS status	LED display		Description
Normal operation	RUN ■ ERR ☐	AX1 ☐ AX2 ☐ AX3 ☐ AX4 ☐	The axes stopped The axes on standby
		AX1-8 ☐*1	
		AX1-16 ☐*1	
	RUN ■ ERR ☐	AX1 ■ AX2 ☐ AX3 ☐ AX4 ☐	The axis in operation
		AX1-8 ■*2	
		AX1-16 ■*2	
Operation failure	RUN ■ ERR ■	AX1 ● AX2 ☐ AX3 ☐ AX4 ☐	Minor error
		AX1-8 ●*3	
		AX1-16 ●*3	
	RUN ■ ERR ●	AX1 ☐ AX2 ☐ AX3 ☐ AX4 ☐	Moderate error Watchdog timer error
		AX1-8 ☐	
		AX1-16 ☐	

*1 When all axes are stopped or on standby, the AX LED turns OFF.

*2 When any of the axes is in operation, the AX LED turns ON.

*3 When an error occurs in any of the axes, the AX LED is flashing.

2 SPECIFICATIONS

This chapter describes the performance specifications of the RD77MS.

2.1 Performance Specifications

This section lists the performance specifications of the RD77MS.

Item		RD77MS2	RD77MS4	RD77MS8	RD77MS16
Number of controlled axes		2 axes	4 axes	8 axes	16 axes
Operation cycle		0.444 ms/0.888 ms/1.777 ms/3.555 ms			
Interpolation function		2-axis linear interpolation, 2-axis circular interpolation	2-, 3-, or 4-axis linear interpolation, 2-axis circular interpolation		
Control system		PTP (Point To Point) control, path control (both linear and arc can be set), speed control, speed-position switching control, position-speed switching control, speed-torque control			
Control unit		mm, inch, degree, pulse			
Positioning data		600 data/axis			
Execution data backup function		Parameters, positioning data, and block start data can be saved on flash ROM. (battery-less backup)			
Positioning	Positioning system	PTP control: Incremental system/absolute system Speed-position switching control: Incremental system/absolute system Position-speed switching control: Incremental system Path control: Incremental system/absolute system			
	Positioning range	In absolute system • -214748364.8 to 214748364.7 (μm) • -21474.83648 to 21474.83647 (inch) • 0 to 359.99999 (degree) • -2147483648 to 2147483647 (pulse) In incremental system • -214748364.8 to 214748364.7 (μm) • -21474.83648 to 21474.83647 (inch) • -21474.83648 to 21474.83647 (degree) • -2147483648 to 2147483647 (pulse) In speed-position switching control (INC mode)/position-speed switching control • 0 to 214748364.7 (μm) • 0 to 21474.83647 (inch) • 0 to 21474.83647 (degree) • 0 to 2147483647 (pulse) In speed-position switching control (ABS mode)[*1] 0 to 359.99999 (degree)			
	Speed command	0.01 to 20000000.00 (mm/min) 0.001 to 2000000.000 (inch/min) 0.001 to 2000000.000 (degree/min)[*2] 1 to 1000000000 (pulse/s)			
	Acceleration/deceleration process	Trapezoidal acceleration/deceleration, S-curve acceleration/deceleration			
	Acceleration/deceleration time	1 to 8388608 (ms) (Four patterns can be set for each of acceleration time and deceleration time.)			
	Sudden stop deceleration time	1 to 8388608 (ms)			

Item			RD77MS2	RD77MS4	RD77MS8	RD77MS16
Starting time[*3]	Operation cycle 0.444 ms	Maximum number of axes: 1 axis	0.7 ms			
		Maximum number of axes: 2 axes	0.7 ms			
		Maximum number of axes: 4 axes	0.74 ms			
	Operation cycle 0.888 ms	Maximum number of axes: 4 axes	1.1 ms			
		Maximum number of axes: 8 axes	1.32 ms			
		Maximum number of axes: 12 axes	1.46 ms			
	Operation cycle 1.777 ms	Maximum number of axes: 8 axes	1.1 ms			
		Maximum number of axes: 12 axes	1.46 ms			
		Maximum number of axes: 16 axes	1.59 ms			
	Operation cycle 3.555 ms	Maximum number of axes: 8 axes	0.92 ms			
		Maximum number of axes: 12 axes	1.12 ms			
		Maximum number of axes: 16 axes	1.52 ms			
External wiring connection system			40-pin connector			
Applicable wire size[*4]	When A6CON1 or A6CON4 is used		0.088 to 0.3 mm^2 (28 to 22 AWG) stranded wire			
	When A6CON2 is used		0.088 to 0.24 mm^2 (28 to 24 AWG) stranded wire			
External input wiring connector			A6CON1, A6CON2, A6CON4 (sold separately)			
Manual pulse generator/ Incremental synchronous encoder input maximum frequency		Differential-output type	Up to 1 Mpulses/s			
		Open-collector type	Up to 200 kpulses/s			
Manual pulse generator 1 pulse input magnification			1 to 10000 times			
Flash ROM write count			Max. 100000 times			
Number of occupied I/O points			32 points (I/O assignment: Intelligent function module 32 points)			
Internal current consumption (5 V DC)			1.0 A			
External dimensions	Height		106 mm (4.17 inch)			
	Width		27.8 mm (1.09 inch)			
	Depth		110 mm (4.33 inch)			
Mass			0.22 kg	0.23 kg		

*1 The speed-position switching control (ABS mode) can be used only when the control unit is "degree".

*2 When "Speed control 10 times multiplier setting for degree axis function" is valid, the setting range is 0.01 to 20000000.00 (degree/min).

*3 Time from accepting the positioning start signal until BUSY signal turns ON.

*4 Use cables with outside diameter of 1.3 mm (0.05 inch) or shorter to connect 40 cables to the connector. In addition, consider the amount of current to be used and select appropriate cables.

2.2 Specifications of Interfaces with External Devices

Electrical specifications of input signals

External input signals

■Specifications of external input signals

Item		Specifications
Signal name		Input signal (SIN)
Number of input points		RD77MS2: 10 points, RD77MS4/RD77MS8/RD77MS16: 20 points
Input method		Positive common/Negative common shared
Common terminal arrangement		4 points/common (Common contact: COM)
Isolation method		Photocoupler
Rated input voltage		24 V DC
Rated input current (I_{IN})		Approx. 5 mA
Operating voltage range		19.2 to 26.4 V DC (24 V DC+10/-20%, ripple ratio 5% or less)
ON voltage/current		17.5 V DC or more/3.5 mA or more
OFF voltage/current		7 V DC or less/1 mA or less
Input resistance		Approx. 6.8 kΩ
Response time	OFF → ON	1 ms or less
	ON → OFF	

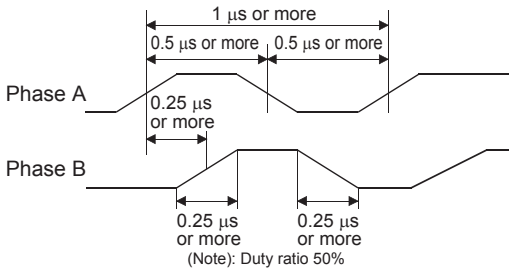
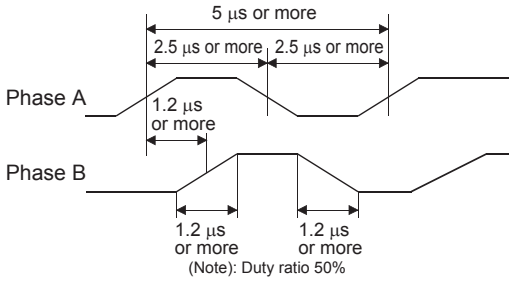
Forced stop input

■Specifications of forced stop input signal

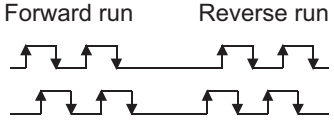
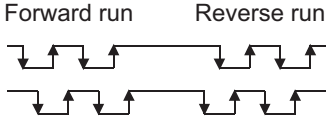
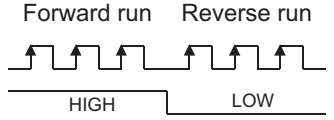
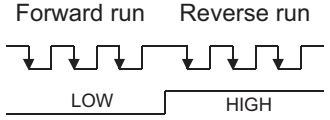
Item		Specifications
Number of input points		1 point
Input method		Positive common/Negative common shared
Common terminal arrangement		1 point/common (Common contact: EMI.COM)
Isolation method		Photocoupler
Rated input voltage		24 V DC
Rated input current (I_{IN})		Approx. 5 mA
Operating voltage range		19.2 to 26.4 V DC (24 V DC+10/-20%, ripple ratio 5% or less)
ON voltage/current		17.5 V DC or more/3.5 mA or more
OFF voltage/current		7 V DC or less/1 mA or less
Input resistance		Approx. 6.8 kΩ
Response time	OFF → ON	4 ms or less
	ON → OFF	

Manual pulse generator/Incremental synchronous encoder input

■Specifications of manual pulse generator/incremental synchronous encoder

Item		Specifications
Signal input form*1		Phase A/Phase B (Magnification by 4/Magnification by 2/Magnification by 1), PULSE/SIGN
Differential-output type (26LS31 or equivalent)	Maximum input pulse frequency	1 Mpulses/s (After magnification by 4, up to 4 Mpulses/s)*2
	Pulse width	1 μs or more
	Leading edge/trailing edge time	0.25 μs or less
	Phase difference	0.25 μs or more
	Rated input voltage	5.5 V DC or less
	High-voltage	2.0 to 5.25 V DC
	Low-voltage	0 to 0.8 V DC
	Differential voltage	±0.2 V
	Cable length	Up to 30 m (98.43 ft.)
	Example of waveform	 (Note): Duty ratio 50%
Voltage-output/Open-collector type (5 V DC)	Maximum input pulse frequency	200 kpulses/s (After magnification by 4, up to 800 kpulses/s)*2
	Pulse width	5 μs or more
	Leading edge/trailing edge time	1.2 μs or less
	Phase difference	1.2 μs or more
	Rated input voltage	5.5 V DC or less
	High-voltage	3.0 to 5.25 V DC/2 mA or less
	Low-voltage	0 to 1.0 V DC/5 mA or more
	Cable length	Up to 10 m (32.81 ft.)
	Example of waveform	 (Note): Duty ratio 50%

*1 Set the signal input form in "[Pr.24] Manual pulse generator/Incremental synchronous encoder input selection".

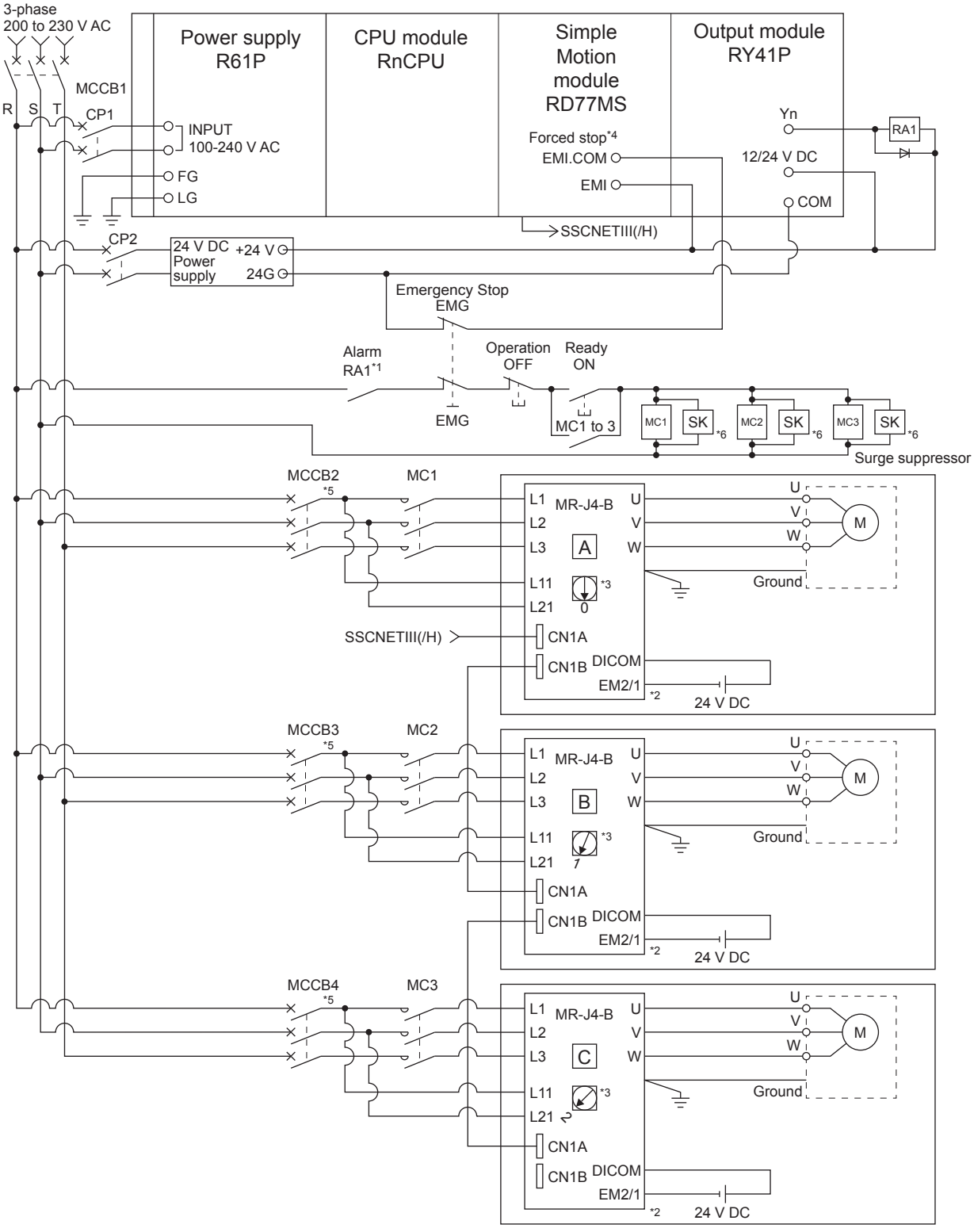
[Pr.24] Manual pulse generator/Incremental synchronous encoder input selection	[Pr.151] Manual pulse generator/Incremental synchronous encoder input logic selection	
	Positive logic	Negative logic
Phase A/Phase B		
PULSE/SIGN		

*2 Maximum input pulse frequency is magnified by 4, when "A-phase/B-phase Magnification by 4" is set in "[Pr.24] Manual pulse generator/Incremental synchronous encoder input selection".

2.3 External Circuit Design

Configure up the power supply circuit and main circuit which turn off the power supply after detection alarm occurrence and servo forced stop. When designing the main circuit of the power supply, make sure to use a circuit breaker (MCCB). The outline diagrams for the external device connection interface are shown below.

Example when using the forced stop of RD77MS



*1 Configure up the power supply circuit which switch off the electromagnetic contactor (MC) after detection alarm occurrence on the CPU module.
*2 It is also possible to use forced stop signal of the servo amplifier.
*3 Set the axis selection rotary switch of servo amplifier as follows to set the axis No. of servo amplifier.

Axis No.	Setting value	Axis No.	Setting value	Axis No.	Setting value	Axis No.	Setting value
Axis 1	0	Axis 5	4	Axis 9	8	Axis 13	C
Axis 2	1	Axis 6	5	Axis 10	9	Axis 14	D
Axis 3	2	Axis 7	6	Axis 11	A	Axis 15	E
Axis 4	3	Axis 8	7	Axis 12	B	Axis 16	F

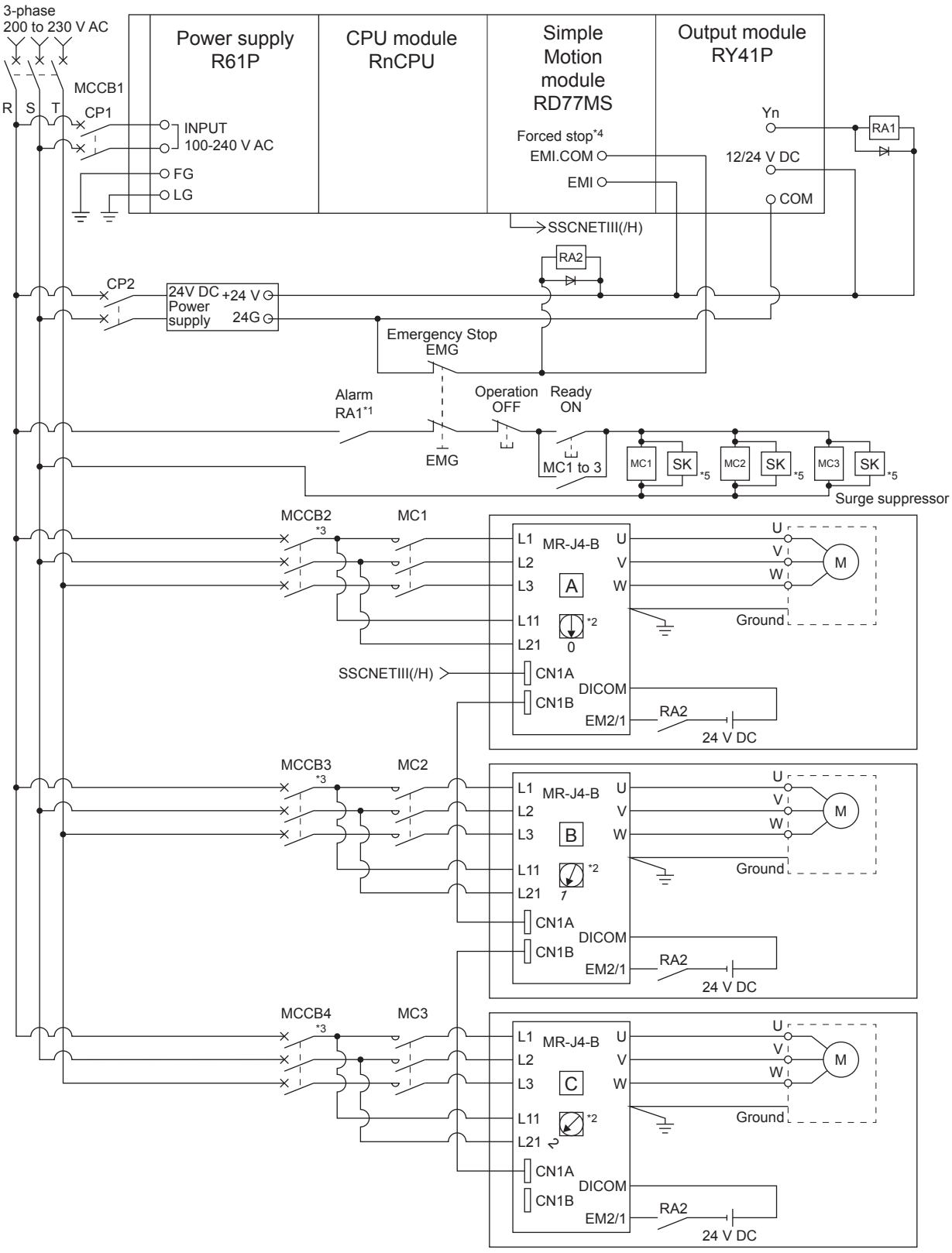
*4 The status of forced stop input signal can be confirmed with "[Md.50] Forced stop input".
*5 Refer to the servo amplifier instruction manual for selection of the circuit breaker and electromagnetic contactor.
*6 The surge suppressor is recommended to be used for an AC relay or electromagnetic contactor (MC) near the servo amplifier. Refer to the servo amplifier instruction manual for selection of the surge suppressor.

Precautions

- Be sure to shut off the both of main circuit power supply L1/L2/L3 and control power supply L11/L21 after disconnection of SSCNET communication by the connect/disconnect function of SSCNET communication at the time of exchange of servo amplifier. At this time, it is not possible to communicate between the servo amplifier and Simple Motion module. Therefore, be sure to exchange the servo amplifier after stopping the operating of machine beforehand.
- If the emergency stop signal of Simple Motion module turns OFF when setting of "[Pr.82] Forced stop valid/invalid selection" to "0: Valid", servomotor is stopped with dynamic brake. (The LED display of servo amplifier indicates "E7.1" (Controller forced stop input warning).)
- When the control power supply of servo amplifier is shut off, it is not possible to communicate with the servo amplifier after that.

Ex.
When the control power supply L11/L21 of servo amplifier in above B figure is shut off, it is also not possible to communicate with the servo amplifier C.
If only a specific servo amplifier main circuit power supply is shut off, be sure to shut off the main circuit power supply L1/L2/L3, and do not shut off the control power supply L11/L21.

Example when using the forced stop of RD77MS and MR-J4-B



*1 Configure up the power supply circuit which switch off the electromagnetic contactor (MC) after detection alarm occurrence on the CPU module.

*2 Set the axis selection rotary switch of servo amplifier as follows to set the axis No. of servo amplifier.

Axis No.	Setting value	Axis No.	Setting value	Axis No.	Setting value	Axis No.	Setting value
Axis 1	0	Axis 5	4	Axis 9	8	Axis 13	C
Axis 2	1	Axis 6	5	Axis 10	9	Axis 14	D
Axis 3	2	Axis 7	6	Axis 11	A	Axis 15	E
Axis 4	3	Axis 8	7	Axis 12	B	Axis 16	F

*3 Refer to the servo amplifier instruction manual for selection of the circuit breaker and electromagnetic contactor.

*4 The status of forced stop input signal can be confirmed with "[Md.50] Forced stop input".

*5 The surge suppressor is recommended to be used for an AC relay or electromagnetic contactor (MC) near the servo amplifier. Refer to the servo amplifier instruction manual for selection of the surge suppressor.

Precautions

- Be sure to shut off the both of main circuit power supply L1/L2/L3 and control power supply L11/L21 after disconnection of SSCNET communication by the connect/disconnect function of SSCNET communication at the time of exchange of servo amplifier. At this time, it is not possible to communicate between the servo amplifier and Simple Motion module. Therefore, be sure to exchange the servo amplifier after stopping the operating of machine beforehand.
- The dynamic brake operates and servomotor occurs to the free run when EM1 (forced stop) of servo amplifier is turned OFF. At the time, the display shows the servo forced stop warning (E6.1). During ordinary operation, do not use the forced stop signal to alternate stop and run. The service life of the servo amplifier may be shortened.
- When the control power supply of servo amplifier is shut off, it is not possible to communicate with the servo amplifier after that.

Ex.

When the control power supply L11/L21 of servo amplifier in above B figure is shut off, it is also not possible to communicate with the servo amplifier C.

If only a specific servo amplifier main circuit power supply is shut off, be sure to shut off the main circuit power supply L1/L2/L3, and do not shut off the control power supply L11/L21.

3 FUNCTION LIST

3.1 Control Functions

The Simple Motion module has several functions. Refer to the following for details on each function.
MELSEC iQ-R Simple Motion Module User's Manual (Application)
In this manual, the Simple Motion module functions are categorized and explained as follows.

Main functions

■Home position return control

"Home position return control" is a function (Fast home position return) that established the start point for carrying out positioning control (Machine home position return), and carries out positioning toward that start point. This is used to return a workpiece, located at a position other than the home position when the power is turned ON or after positioning stop, to the home position. The "home position return control" is pre-registered in the Simple Motion module as the "Positioning start data No. 9001 (Machine home position return)", and "Positioning start data No. 9002 (Fast home position return)".

■Major positioning control

This control is carried out using the "Positioning data" stored in the Simple Motion module. Positioning control, such as position control and speed control, is executed by setting the required items in this "positioning data" and starting that positioning data. An "operation pattern" can be set in this "positioning data", and with this whether to carry out control with continuous positioning data (ex.: positioning data No. 1, No. 2, No. 3, etc.) can be set.

■High-level positioning control

This control executes the "positioning data" stored in the Simple Motion module using the "block start data". The following types of applied positioning control can be carried out.

- Random blocks, handling several continuing positioning data items as "blocks", can be executed in the designated order.
- "Condition judgment" can be added to position control and speed control.
- The operation of the positioning data that is set for multiple axes can be started simultaneously. (Command is output simultaneously to multiple servo amplifiers.)
- The designated positioning data can be executed repeatedly,

etc.

■Manual control

The Simple Motion module executes the random positioning operation by inputting a signal into the Simple Motion module from an external device.
Use this manual control to move the workpiece to a random position (JOG operation), and to finely adjust the positioning (inching operation, manual pulse generator operation), etc.

■Expansion control

The following controls other than the positioning control can be executed.

- Speed control and torque control not including position loop for the command to servo amplifier (Speed-torque control).
- Synchronous control with gear, shaft, change gear and cam not by mechanical, but by software use "synchronous control parameter", and is synchronized with input axis (Synchronous control).

Sub functions

When the main functions are executed, this function compensates and limits controls, or adds functions.

Common functions

Common control using the Simple Motion module for "Parameter initialization function" or "Execution data backup function" can be carried out.

3.2 Main Functions

The outline of the main functions for positioning control with the Simple Motion module is described below.

Main functions			Details
Home position return control	Machine home position return control		Mechanically establishes the positioning start point using a near-point dog, etc. In the data setting method, no axis movement occurs since the current position is set as the home position. (Positioning start No. 9001)
	Fast home position return control		Positions a target to the home position address ([Md.21] Machine feed value) stored in the Simple Motion module using machine home position return. (Positioning start No. 9002)
Major positioning control	Position control	Linear control (1-axis linear control) (2-axis linear interpolation control) (3-axis linear interpolation control) (4-axis linear interpolation control)	Positions a target using a linear path to the address set in the positioning data or to the position designated with the movement amount.
		Fixed-feed control (1-axis fixed-feed control) (2-axis fixed-feed control) (3-axis fixed-feed control) (4-axis fixed-feed control)	Positions a target by the movement amount designated with the amount set in the positioning data. (With fixed-feed control, the "[Md.20] Current feed value" is set to "0" when the control is started. With 2-, 3-, or 4-axis fixed-feed control, the fixed-feed is fed along a linear path obtained by interpolation.)
		2-axis circular interpolation control	Positions a target using an arc path to the address set in the positioning data, or to the position designated with the movement amount, sub point or center point.
	Speed control	Speed control (1-axis speed control) (2-axis speed control) (3-axis speed control) (4-axis speed control)	Continuously outputs the command corresponding to the command speed set in the positioning data.
	Speed-position switching control		First, carries out speed control, and then carries out position control (positioning with designated address or movement amount) by turning the "speed-position switching signal" ON.
	Position-speed switching control		First, carries out position control, and then carries out speed control (continuous output of the command corresponding to the designated command speed) by turning the "position-speed switching signal" ON.
	Other control	Current value changing	Changes the current feed value ([Md.20]) to the address set in the positioning data. The following two methods can be used. (The machine feed value ([Md.21]) cannot be changed.) • Current value changing using positioning data • Current value changing using current value changing start No. (No. 9003)
		NOP instruction	No execution control system. When NOP instruction is set, this instruction is not executed and the operation of the next data is started.
		JUMP instruction	Unconditionally or conditionally jumps to designated positioning data No.
		LOOP	Carries out loop control with repeated LOOP to LEND.
		LEND	Returns to the beginning of the loop control with repeated LOOP to LEND.
High-level positioning control	Block start (Normal start)		With one start, executes the positioning data in a random block with the set order.
	Condition start		Carries out condition judgment set in the "condition data" for the designated positioning data, and then executes the "block start data". When the condition is established, the "block start data" is executed. When not established, that "block start data" is ignored, and the next point's "block start data" is executed.
	Wait start		Carries out condition judgment set in the "condition data" for the designated positioning data, and then executes the "block start data". When the condition is established, the "block start data" is executed. When not established, stops the control until the condition is established. (Waits.)
	Simultaneous start		Simultaneously executes the positioning data having the No. for the axis designated with the "condition data". (Outputs commands at the same timing.)
	Repeated start (FOR loop)		Repeats the program from the block start data set with the "FOR loop" to the block start data set in "NEXT" for the designated number of times.
	Repeated start (FOR condition)		Repeats the program from the block start data set with the "FOR condition" to the block start data set in "NEXT" until the conditions set in the "condition data" are established.

Main functions		Details
Manual control	JOG operation	Outputs a command to servo amplifier while the JOG start signal is ON.
	Inching operation	Outputs commands corresponding to minute movement amount by manual operation to servo amplifier. (Performs fine adjustment with the JOG start signal.)
	Manual pulse generator operation	Outputs pulses commanded with the manual pulse generator to servo amplifier.
Expansion control	Speed-torque control	Carries out the speed control or torque control that does not include the position loop for the command to servo amplifier by switching control mode.
	Synchronous control	Carries out the synchronous control that synchronizes with input axis by setting the system such as gear, shaft, change gear and cam to the "synchronous control parameter".

In "major positioning control" ("high-level positioning control"), "Operation pattern" can be set to designate whether to continue executing positioning data. Outlines of the "operation patterns" are given below.

[Da.1] Operation pattern	Details
Independent positioning control (positioning complete)	When "independent positioning control" is set for the operation pattern of the started positioning data, only the designated positioning data will be executed, and then the positioning will end.
Continuous positioning control	When "continuous positioning control" is set for the operation pattern of the started positioning data, after the designated positioning data is executed, the program will stop once, and then the next following positioning data will be executed.
Continuous path control	When "continuous path control" is set for the operation pattern of the started positioning data, the designated positioning data will be executed, and then without decelerating, the next following positioning data will be executed.

3.3 Sub Functions and Common Functions

Sub functions

The outline of the functions that assist positioning control using the Simple Motion module is described below.

Sub function		Details
Functions characteristic to machine home position return	Home position return retry function	This function retries the home position return with the upper/lower limit switches during the machine home position return. This allows machine home position return to be carried out even if the axis is not returned to before the near-point dog with JOG operation, etc.
	Home position shift function	After returning to the machine home position, this function compensates the position by the designated distance from the machine home position and sets that position as the home position address.
Functions that compensate control	Backlash compensation function	This function compensates the mechanical backlash amount. Feed commands equivalent to the set backlash amount are output each time the movement direction changes.
	Electronic gear function	By setting the movement amount per pulse, this function can freely change the machine movement amount per commanded pulse. When the movement amount per pulse is set, a flexible positioning system that matches the machine system can be structured.
	Near pass function[*1]	This function suppresses the machine vibration when the speed is changed during continuous path control in the interpolation control.
Functions that limit control	Speed limit function	If the command speed exceeds "[Pr.8] Speed limit value" during control, this function limits the commanded speed to within the "[Pr.8] Speed limit value" setting range.
	Torque limit function	If the torque generated by the servomotor exceeds "[Pr.17] Torque limit setting value" during control, this function limits the generated torque to within the "[Pr.17] Torque limit setting value" setting range.
	Software stroke limit function	If a command outside of the upper/lower limit stroke limit setting range, set in the parameters, is issued, this function will not execute positioning for that command.
	Hardware stroke limit function	This function carries out deceleration stop with the hardware stroke limit switch.
	Forced stop function	This function stops all axes of the servo amplifier with the forced stop input signal connected to the external input connection connector on the Simple Motion module.
Functions that change control details	Speed change function	This function changes the speed during positioning. Set the new speed in the speed change buffer memory ([Cd.14] New speed value), and change the speed with the speed change request ([Cd.15]).
	Override function	This function changes the speed within a percentage of 0 to 300% during positioning. This is executed using "[Cd.13] Positioning operation speed override".
	Acceleration/deceleration time change function	This function changes the acceleration/deceleration time during speed change.
	Torque change function	This function changes the "torque limit value" during control.
	Target position change function	This function changes the target position during positioning. Position and speed can be changed simultaneously.
Functions related to positioning start	Pre-reading start function	This function shortens the virtual start time.
Absolute position system		This function restores the absolute position of designated axis.
Functions related to positioning stop	Stop command processing for deceleration stop function	Function that selects a deceleration curve when a stop cause occurs during deceleration stop processing to speed 0.
	Continuous operation interrupt function	This function interrupts continuous operation. When this request is accepted, the operation stops when the execution of the current positioning data is completed.
	Step function	This function temporarily stops the operation to confirm the positioning operation during debugging, etc. The operation can be stopped at each "automatic deceleration" or "positioning data".

Sub function		Details
Other functions	Skip function	This function stops (decelerates to a stop) the positioning being executed when the skip signal is input, and carries out the next positioning.
	M code output function	This function issues a command for a sub work (clamp or drill stop, tool change, etc.) corresponding to the M code No. (0 to 65535) that can be set for each positioning data. The M code output timing can be set for each positioning data.
	Teaching function	This function stores the address positioned with manual control into the "[Da.6] Positioning address/ movement amount" having the designated positioning data No. ([Cd.39]).
	Command in-position function	This function calculates the remaining distance for the Simple Motion module to reach the positioning stop position. When the value is less than the set value, the "command in-position flag" is set to "1". When using another auxiliary work before ending the control, use this function as a trigger for the sub work.
	Acceleration/deceleration processing function	This function adjusts the acceleration/deceleration.
	Deceleration start flag function	Function that turns ON the flag when the constant speed status or acceleration status switches to the deceleration status during position control, whose operation pattern is "Positioning complete", to make the stop timing known.
	Follow up function	This function monitors the motor rotation amount with the servo turned OFF, and reflects it on the current feed value.
	Speed control 10 times multiplier setting for degree axis function	This function executes the positioning control by the 10 times speed of the command speed and the speed limit value when the setting unit is "degree".
	Operation setting for incompletion of home position return function	This function is provided to select whether positioning control is operated or not, when the home position return request flag is ON.

*1 The near pass function is featured as standard and is valid only for position control. It cannot be set to be invalid with parameters.

Common functions

The outline of the functions executed as necessary is described below.

Common functions	Details
Parameter initialization function	This function returns the setting data stored in the buffer memory/internal memory and flash ROM/internal memory (nonvolatile) of Simple Motion module to the default values. The following two methods can be used. • Method using a program • Method using an engineering tool
Execution data backup function	This function writes the execution data being used in the control into the flash ROM/internal memory (nonvolatile). The following two methods can be used. • Method using a program • Method using an engineering tool
External input signal select function	This function sets the input type, input terminal, signal logic and input filter for each external input signal of each axis (upper/lower stroke limit signal (FLS/RLS), near-point dog signal (DOG), and stop signal (STOP)). The function enables the assignment of external input signal of each axis to any terminals of 20 points of the external input connection connector on the Simple Motion module.
History monitor function	This function monitors start history and current value history of all axes.
Amplifier-less operation function	This function executes the positioning control of Simple Motion module without connecting to the servo amplifiers. It is used to debug the program at the start-up of the device or simulate the positioning operation.
Virtual servo amplifier function	This function executes the operation as the axis (virtual servo amplifier axis) that operates only command (instruction) virtually without servo amplifiers.
Driver communication function	This function uses the "Master-slave operation function" of servo amplifier. The Simple Motion module controls the master axis and the slave axis is controlled by data communication between servo amplifiers (driver communication) without Simple Motion module.
Mark detection function	This function is used to latch any data at the input timing of the mark detection signal (DI).
Optional data monitor function	This function is used to store the data selected by user up to 4 data per axis to buffer memory and monitor them.
Event history function	This function collects errors and event information occurred in the Simple Motion module in the CPU module, and saves them to an SD memory card. This function enables to check the error history even after the power OFF or reset by holding the error contents in the CPU module.
Connect/disconnect function of SSCNET communication	Temporarily connect/disconnect of SSCNET communication is executed during system's power supply ON. This function is used to exchange the servo amplifiers or SSCNETⅢ cables.

3.4 Combination of Main Functions and Sub Functions

With positioning control using the Simple Motion module, the main functions and sub functions can be combined and used as necessary. A list of the main function and sub function combinations is given below.

Combination of main functions and operation patterns

○: Setting possible

△: Setting limited

×: Setting not possible

Main functions			Combination with operation pattern*1
Home position return control	Machine home position return control		×
	Fast home position return control		×
Major positioning control	Position control	1-axis linear control	○
		2-, 3-, or 4-axis linear interpolation control	○
		1-axis fixed-feed control	△ (Continuous path control cannot be set)
		2-, 3-, or 4-axis fixed-feed control (interpolation)	△ (Continuous path control cannot be set)
		2-axis circular interpolation control	○
	Speed control (1- to 4-axis)		△ (Only independent positioning control can be set)
	Speed-position switching control		△ (Continuous path control cannot be set)
	Position-speed switching control		△ (Only independent positioning control can be set)
	Other control	Current value changing	△ (Continuous path control cannot be set)
		NOP instruction	×
		JUMP instruction	×
		LOOP to LEND	
Manual control	JOG operation, inching operation		×
	Manual pulse generator operation		×
Expansion control	Speed-torque control		×

*1 The operation pattern is one of the "positioning data" setting items.

Combination of main functions and sub functions

○: Combination possible

△: Combination limited

×: Combination not possible

Main functions			Functions characteristic to machine home position return		Functions that compensate control		
			Home position return retry function	Home position shift function	Backlash compensation function	Electronic gear function	Near pass function
Home position return control	Machine home position return control		△*1	○	○	○	*2
	Fast home position return control		×	×	○	○	
Major positioning control	Position control	1-axis linear control	×	×	○	○	
		2-, 3-, or 4-axis linear interpolation control	×	×	○	○	
		1-axis fixed-feed control	×	×	○	○	
		2-, 3-, or 4-axis fixed-feed control (interpolation)	×	×	○	○	
		2-axis circular interpolation control	×	×	○	○	
	Speed control (1- to 4-axis)		×	×	○	○	
	Speed-position switching control		×	×	○	○	
	Position-speed switching control						
	Other control	Current value changing	×	×	×	×	
		NOP instruction					
		JUMP instruction	×	×	×	×	
		LOOP to LEND					
Manual control	JOG operation, inching operation		×	×	○	○	×
	Manual pulse generator operation		×	×	○	○	×
Expansion control	Speed-torque control		×	×	×	○	×

*1 Home position return retry function cannot be used during the scale origin signal detection method machine home position return.

*2 The near pass function is featured as standard and is valid only for setting continuous path control for position control.

◎: Always combine

○: Combination possible

×: Combination not possible

Main functions			Functions that limit control				
			Speed limit function	Torque limit function	Software stroke limit function	Hardware stroke limit function	Forced stop function
Home position return control	Machine home position return control		○	○	×	◎	○
	Fast home position return control		○	○	×	◎	○
Major positioning control	Position control	1-axis linear control	○	○	○	◎	○
		2-, 3-, or 4-axis linear interpolation control	○	○	○	◎	○
		1-axis fixed-feed control	○	○	○	◎	○
		2-, 3-, or 4-axis fixed-feed control (interpolation)	○	○	○	◎	○
		2-axis circular interpolation control	○	○	○	◎	○
	Speed control (1- to 4-axis)		○	○	○	◎	○
	Speed-position switching control		○	○	○	◎	○
	Position-speed switching control						
	Other control	Current value changing	×	×	○	◎	○
		NOP instruction			×	×	
		JUMP instruction	×	×	×	×	○
		LOOP to LEND					
Manual control	JOG operation, inching operation		○	○	○	◎	○
	Manual pulse generator operation		○	○	○	◎	○
Expansion control	Speed-torque control		○	○	○	◎	○

○: Combination possible

△: Combination limited

×: Combination not possible

Main functions			Functions that change control details				
			Speed change function	Override function	Acceleration/ deceleration time change function	Torque change function	Target position change function
Home position return control	Machine home position return control		△*1	△*1	△*1	○	×
	Fast home position return control		○	○	○	○	×
Major positioning control	Position control	1-axis linear control	○	○	○	○	△*2
		2-, 3-, or 4-axis linear interpolation control	○	○	○	○	×
		1-axis fixed-feed control	○	○	○	○	×
		2-, 3-, or 4-axis fixed-feed control (interpolation)	○	○	○	○	×
		2-axis circular interpolation control	○	○	○	○	×
	Speed control (1- to 4-axis)		○	○	○	○	×
	Speed-position switching control		○	○	○	○	×
	Position-speed switching control						
	Other control	Current value changing	×	×	×	×	×
		NOP instruction					
		JUMP instruction	×	×	×	×	×
		LOOP to LEND					
Manual control	JOG operation, inching operation		△*3	△*3	△*3	○	×
	Manual pulse generator operation		×	×	×	○	×
Expansion control	Speed-torque control		×	×	×	○	×

*1 Invalid during creep speed.

*2 Invalid during continuous path control.

*3 Combination with the inching operation is not available. (Inching operation does not perform acceleration/deceleration processing.)

○: Combination possible

△: Combination limited

×: Combination not possible

Main functions			Functions related to positioning start	Functions related to positioning stop		Other functions	
			Pre-reading start function	Step function	Stop command processing for deceleration stop function	Skip function	M code output function
Home position return control	Machine home position return control		×	×	○	×	×
	Fast home position return control		×	×	○	×	×
Major positioning control	Position control	1-axis linear control	○	○	○	○	○
		2-, 3-, or 4-axis linear interpolation control	○	○	○	○	○
		1-axis fixed-feed control	○	○	○	○	○
		2-, 3-, or 4-axis fixed-feed control (interpolation)	○	○	○	○	○
		2-axis circular interpolation control	○	○	○	○	○
	Speed control (1- to 4-axis)		○	×	○	×	○
	Speed-position switching control		○	○	○	○	○
	Position-speed switching control					×	
	Other control	Current value changing	×	○	×	○	△*1
		NOP instruction		×		×	×
		JUMP instruction	×	×	×	×	×
		LOOP to LEND					
Manual control	JOG operation, inching operation		×	×	×	×	×
	Manual pulse generator operation		×	×	×	×	×
Expansion control	Speed-torque control		×	×	×	×	×

*1 Change the current value using the positioning data. Disabled for a start of positioning start No. 9003.

○: Combination possible

△: Combination limited

×: Combination not possible

Main functions			Other functions					
			Teaching function	Command in-position function	Acceleration/ deceleration processing function	Deceleration start flag function	Speed control 10 times multiplier setting for degree axis function	Operation setting for incompletion of home position return function
Home position return control	Machine home position return control		×	×	○	×	○	×
	Fast home position return control		×	○	○	×	○	×
Major positioning control	Position control	1-axis linear control	×	○	○	○	○	○
		2-, 3-, or 4-axis linear interpolation control	×	○	○	△*1	○	○
		1-axis fixed-feed control	×	○	○	○	○	○
		2-, 3-, or 4-axis fixed-feed control (interpolation)	×	○	○	△*1	○	○
		2-axis circular interpolation control	×	○	○	×	×	○
	Speed control (1- to 4-axis)		×	×	○	×	○	○
	Speed-position switching control		×	○	○	△*2	○	○
	Position-speed switching control							
	Other control	Current value changing	×	×	×	×	×	△*3
		NOP instruction						×
		JUMP instruction	×	×	×	×	×	×
		LOOP to LEND						
Manual control	JOG operation, inching operation		○	×	△*4	×	○	×
	Manual pulse generator operation		○	×	×	×	△*5	×
Expansion control	Speed-torque control		×	×	△*6	×	○	○

*1 Valid for the reference axis only.

*2 Valid for only the case where a deceleration start is made during position control.

*3 Valid for a start of positioning start No.9003, but invalid for a start of positioning data (No. 1 to 600).

*4 Combination with the inching operation is not available. (Inching operation does not perform acceleration/deceleration processing.)

*5 Valid for "[Md.22] Feedrate" and "[Md.28] Axis feedrate".

*6 Refer to the following for acceleration/deceleration processing in the speed-torque control.
MELSEC iQ-R Simple Motion Module User's Manual (Application)

4 PROCEDURES BEFORE OPERATIONS

This chapter describes the procedures before operation.

1. Mounting the module

Mount the RD77MS to the main base unit or extension base unit. For details, refer to the following.

MELSEC iQ-R Module Configuration Manual

2. Wiring

Connect the RD77MS to external devices.

3. Adding the module

Add the RD77MS to the module map of the project using an engineering tool.

4. Module setting

Set values for the module setting using an engineering tool. For details, refer to the following.

MELSEC iQ-R Simple Motion Module User's Manual (Application)

5. Auto refresh setting

Set values for the refresh settings using an engineering tool. For details, refer to the following.

MELSEC iQ-R Simple Motion Module User's Manual (Application)

6. Checking connection

Check that the RD77MS is connected to external devices correctly.

7. Programming

Create programs. For details, refer to the following.

MELSEC iQ-R Simple Motion Module User's Manual (Application)

8. Test operation

Check that the positioning is correctly carried out as designed.

5 WIRING

5.1 Precautions for Wiring

The precautions for wiring the Simple Motion module are shown below. Execute the work following the precautions below.

Warning for wiring

⚠WARNING

- Completely turn off the externally supplied power used in the system before installation or wiring. Not doing so could result in electric shock or damage to the product.

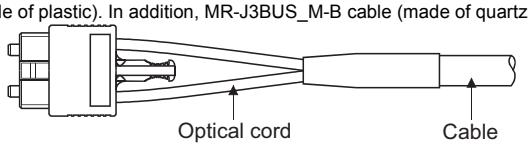
Caution for wiring

⚠CAUTION

- Check the layout of the terminals and then properly route the wires to the module.
- Connectors for external input signal must be crimped or pressured with the tool specified by the manufacturer, or must be correctly soldered. Insufficient connections may cause short circuit, fire, or malfunction.
- Be careful not to let foreign matter such as sawdust or wire chips get inside the module. These may cause fires, failure or malfunction.
- The top surface of the module is covered with protective films to prevent foreign objects such as cable off cuts from entering the module when wiring. Do not remove this film until the wiring is complete. Before operating the system, be sure to remove the film to provide adequate ventilation.
- Securely connect the connector for SSCNETⅢ cable to the bottom connector on the module.
- When removing the cable from the module, do not pull the cable. Hold the connector that is connected to the module. Pulling the cable that is still connected to the module may cause malfunction or damage to the module or cable.
- The external input/output signal cable and the communication cable should not be routed near or bundled with the main circuit cable, power cable and/or other such load - carrying cables other than those for the PLC. These cables should be separated by at least 100 mm (3.94 inch) or more. They can cause electrical interference, surges and inductance that can lead to mis-operation.
- The shielded cable for connecting Simple Motion module can be secured in place. If the shielded cable is not secured, unevenness or movement of the shielded cable or careless pulling on it could result in damage to the Simple Motion module, servo amplifier or shielded cable or defective cable connections could cause mis-operation of the unit.
- If the cable connected to the Simple Motion module and the power line must be adjacently laid (less than 100 mm (3.94 inch)), use a shielded cable. Ground the shield of the cable securely to the control panel on the Simple Motion module side.
- Forcibly removal the SSCNETⅢ cable from the Simple Motion module will damage the Simple Motion module and SSCNETⅢ cables.
- After removal of the SSCNETⅢ cable, be sure to put a cap on the SSCNETⅢ connector. Otherwise, adhesion of dirt deteriorates in characteristic and it may cause malfunctions.
- Do not remove the SSCNETⅢ cable while turning on the power supply of Simple Motion module and servo amplifier. Do not see directly the light generated from SSCNETⅢ connector and the end of SSCNETⅢ cable. When the light gets into eye, may feel something wrong with eyes.(The light source of SSCNETⅢ cable complies with class1 defined in JISC6802 or IEC60825-1.)
- If a power such as a major shock, lateral pressure, haul, sudden bending or twist is added to the SSCNETⅢ cable, it distorts or breaks inside and optical transmission is not be available. Note that the short SSCNETⅢ cable can be twisted easily.
- Be sure to use the SSCNETⅢ cable within the range of operating temperature described in each servo amplifier instruction manual. Especially, as optical fiber for MR-J3BUS_M and MR-J3BUS_M-A are made of synthetic resin, it melts down if being left near the fire or high temperature. Therefore, do not make it touched the part which becomes high temperature, such as radiator or regenerative option of servo amplifier, or servomotor.
- When laying the SSCNETⅢ cable, be sure to secure the minimum cable bend radius or more.
- Put the SSCNETⅢ cable in the duct or fix the cable at the closest part to the Simple Motion module with bundle material in order to prevent SSCNETⅢ cable from putting its own weight on SSCNETⅢ connector. When laying cable, the optical cord should be given loose slack to avoid from becoming smaller than the minimum bend radius, and it should not be twisted. Also, fix and hold it in position with using cushioning such as sponge or rubber which does not contain plasticizing material. If adhesive tape for bundling the cable is used, fire resistant acetate cloth adhesive tape 570F (Teraoka Seisakusho Co., Ltd) is recommended.

⚠CAUTION

- Migrating plasticizer is used for vinyl tape. Keep the MR-J3BUS_M, and MR-J3BUS_M-A cables away from vinyl tape because the optical characteristic may be affected. Generally, soft polyvinyl chloride (PVC), polyethylene resin (PE) and fluorine resin contain non-migrating plasticizer and they do not affect the optical characteristic of SSCNETⅢ cable. However, some wire sheaths and cable ties, which contain migrating plasticizer (phthalate ester), may affect MR-J3BUS_M and MR-J3BUS_M-A cables (made of plastic). In addition, MR-J3BUS_M-B cable (made of quartz glass) is not affected by plasticizer.



○: Normally, cable is not affected by plasticizer.

△: Phthalate ester plasticizer such as DBP and DOP may affect optical characteristic of cable.

SSCNETⅢ cable	Cord	Cable
MR-J3BUS_M	△	
MR-J3BUS_M-A	△	△
MR-J3BUS_M-B	○	○

- If the adhesion of solvent and oil to the cord part of SSCNETⅢ cable may lower the optical characteristic and machine characteristic. To use the cable in that environment, be sure to do the protection measures to the cord part.
- When keeping the Simple Motion module or servo amplifier, be sure to attach a cap to the connector part so that a dirt should not adhere to the end of SSCNETⅢ connector.
- To protect a light device inside a connector from dust, a cap is attached to the SSCNETⅢ connector for the SSCNETⅢ cable. Therefore, do not remove a cap until just before connecting the SSCNETⅢ cable. Also, when removing the SSCNETⅢ cable, make sure to attach a cap.
- Keep the cap and the tube for protecting light cord end of SSCNETⅢ cable in a plastic bag with a zipper included with the SSCNETⅢ cable to prevent them from becoming dirty.
- When exchanging the Simple Motion module or servo amplifier, make sure to attach a cap to the SSCNETⅢ connector. When asking repair of Simple Motion module or servo amplifier for some troubles, make also sure to attach a cap to the SSCNETⅢ connector. When a cap is not attached, the light device may be damaged at the transit. In this case, exchange or repair of the light device is required.

Precautions for wiring

- Use separate cables for connecting to the Simple Motion module and for the power cable that creates surge and inductance.
- The cable for connecting the Simple Motion module should be placed in the duct or secured in place by clamps. If the cable is not placed in the duct or secured by clamps, unevenness or movement of the cable or careless pulling on it could result in damage to the unit or cable or defective cable connections could cause mis-operation of the unit.
- If a duct is being used, separate the cables to connect the Simple Motion module from the power line duct, or use metal piping. Ground the pipes securely after metal piping.
- Use the twisted pair shielded cable (wire size 0.3 mm^2 or more). The shielded must be grounded on the Simple Motion module side.
- Use separate shielded cables for the external input signal, forced stop input, and manual pulse generator/incremental synchronous encoder input for connecting to the Simple Motion module. They can cause electrical interference, surges and inductance that can lead to mis-operation.
- For wiring, refer to the following and each servo amplifier instruction manual.

📖MELSEC iQ-R Module Configuration Manual

Precautions for SSCNETⅢ cable wiring

SSCNETⅢ cable is made from optical fiber. If optical fiber is added a power such as a major shock, lateral pressure, haul, sudden bending or twist, its inside distorts or breaks, and optical transmission will not be available. Especially, as optical fiber for MR-J3BUS_M, MR-J3BUS_M-A is made of synthetic resin, it melts down if being left near the fire or high temperature. Therefore, do not make it touched the part which becomes high temperature, such as radiator or regenerative option of servo amplifier and servomotor. Be sure to use optical fiber within the range of operating temperature described in each servo amplifier instruction manual. Read described item of this section carefully and handle it with caution.

■Minimum bend radius

Make sure to lay the cable with greater radius than the minimum bend radius.

Do not press the cable to edges of equipment or others. For SSCNETⅢ cable, the appropriate length should be selected with due consideration for the dimensions and arrangement of Simple Motion module or servo amplifier. When closing the door of control panel, pay careful attention for avoiding the case that SSCNETⅢ cable is hold down by the door and the cable bend becomes smaller than the minimum bend radius.

Model name of SSCNETⅢ cable	Minimum bend radius [mm] ([inch])
MR-J3BUS_M	25 (0.98)
MR-J3BUS_M-A	Enforced covering cord: 50 (1.97), Cord: 25 (0.98)
MR-J3BUS_M-B	Enforced covering cord: 50 (1.97), Cord: 30 (1.18)

■Tension

If tension is added on the SSCNETⅢ cable, the increase of transmission loss occurs because of external force which concentrates on the fixing part of SSCNETⅢ cable or the connecting part of SSCNETⅢ connector. At worst, the breakage of SSCNETⅢ cable or damage of SSCNETⅢ connector may occur. For cable laying, handle without putting forced tension. (Refer to each servo amplifier instruction manual for the tension strength of SSCNETⅢ cable.)

■Lateral pressure

If lateral pressure is added on the SSCNETⅢ cable, the cable itself distorts, internal optical fiber gets stressed, and then transmission loss will increase. At worst, the breakage of SSCNETⅢ cable may occur. As the same condition also occurs at cable laying, do not tighten up SSCNETⅢ cable with a thing such as nylon band (TY-RAP).

Do not trample it down or tuck it down with the door of control box or others.

■Twisting

If the SSCNETⅢ cable is twisted, it will become the same stress added condition as when local lateral pressure or bend is added. Consequently, transmission loss increases, and the breakage of SSCNETⅢ cable may occur at worst.

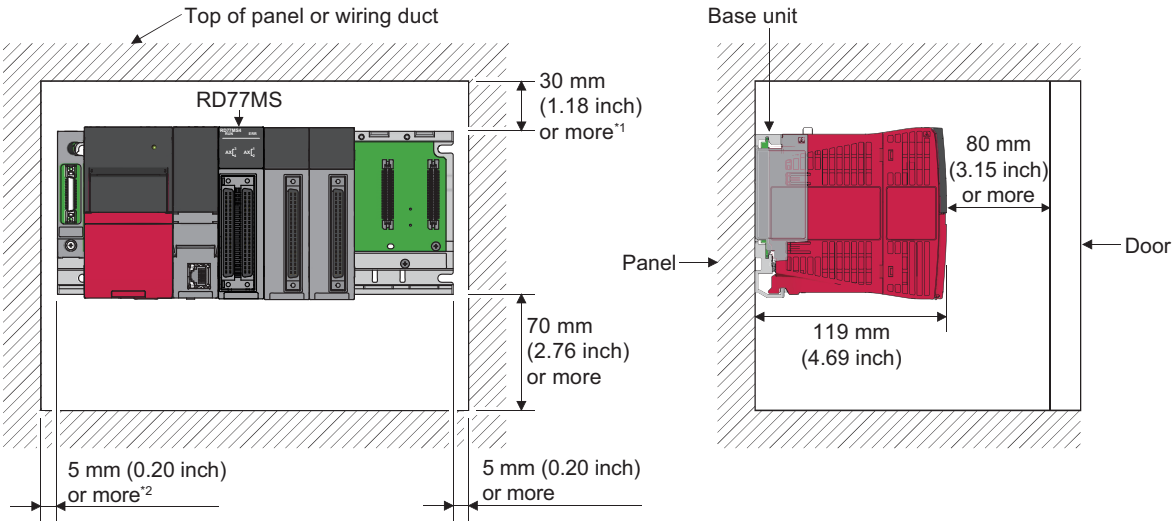
■Disposal

When incinerating optical cable (cord) used for SSCNETⅢ cable, hydrogen fluoride gas or hydrogen chloride gas which is corrosive and harmful may be generated. For disposal of SSCNETⅢ cable, request for specialized industrial waste disposal services that have incineration facility for disposing hydrogen fluoride gas or hydrogen chloride gas.

■Wiring process of SSCNETⅢ cable

Put the SSCNET cable in the duct or fix the cable at the closest part to the Simple Motion module with bundle material in order to prevent SSCNET cable from putting its own weight on SSCNET connector. Leave the following space for wiring.

• Putting in the duct

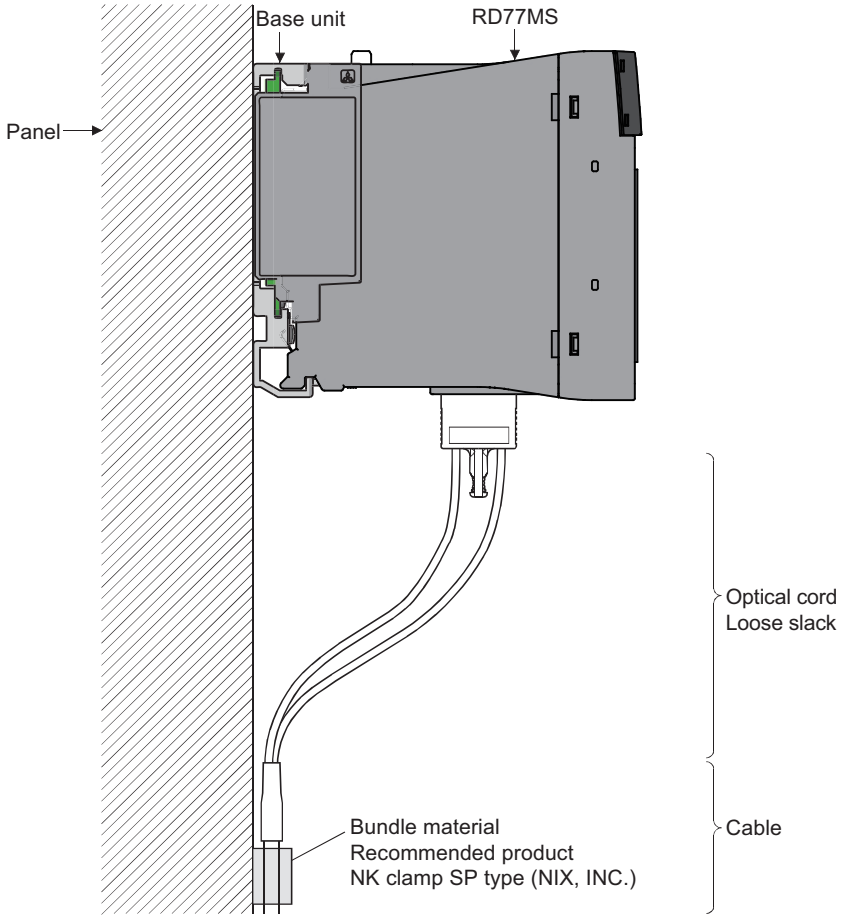


*1 For wiring duct with 50 mm (1.97 inch) or less height. For other cases, 40 mm (1.58 inch) or more.

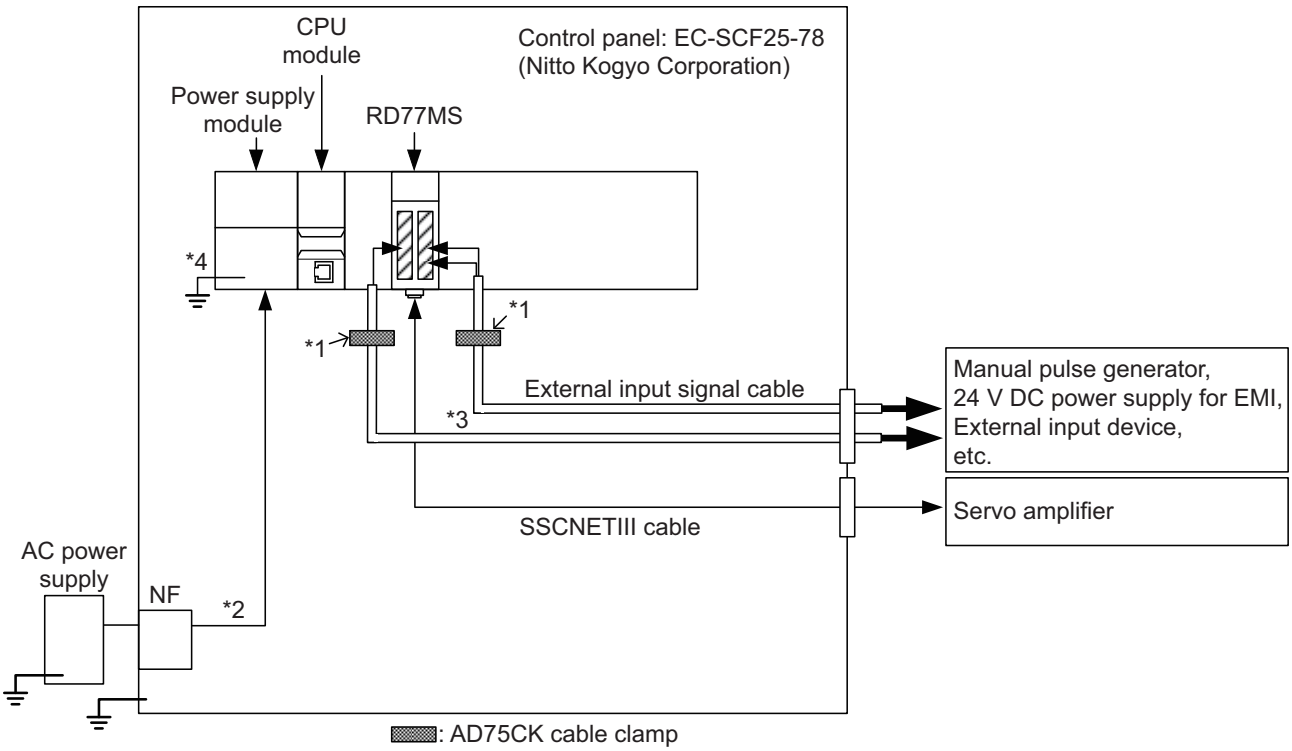
*2 20 mm (0.79 inch) or more when the adjacent module is not removed and the extension cable is connected.

• Bundle fixing

Optical cord should be given loose slack to avoid from becoming smaller than the minimum bend radius, and it should not be twisted. When laying cable, fix and hold it in position with using cushioning such as sponge or rubber which does not contain plasticizing material.



Example of measure against noise for compliance with the EMC directive



*1 Ground the cables at a position within 30 cm (11.82 inch) from the module with the cable clamp.

*2 Wire the power supply cable as short as possible using the twisted cable (2 mm^2 or more).

*3 Use the shielded twisted cable (cable length: 30 m (98.43 ft.) or less) for the external input signal cable.
(Manual pulse generator cable (open-collector type): 10 m or less)

*4 Wire the power supply module as short as possible using the cable of approx. 2 mm^2, and ground to the control panel from the FG/LG terminal.

- Refer to this chapter or "EMC and Low Voltage Directives" of the following manuals for basic wire. We examined RD77MS by the above example.

📖MELSEC iQ-R Module Configuration Manual

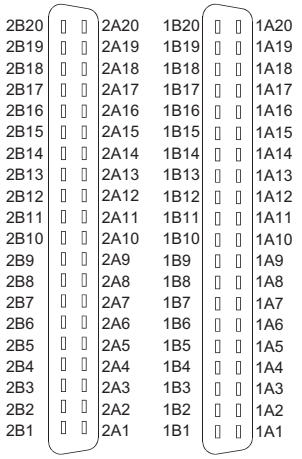
📖Safety Guidelines (This manual is included with the base unit.)

- In wiring inside the panel, the power line connected to the power or servo amplifier and the communication cable such as an expansion cable or a network cable must not be mixed. In the duct, leave 10 cm (3.94 inch) or more between the power line and the communication cable, and separate using a separator (made of metal), etc. It is required in the same control panel as well. Mixing the power line and communication cable may cause increase of noise or malfunction due to noise influence.

5.2 External Input Connection Connector

Signal layout for external input connection connector

The signal layout for the external input connection connector of Simple Motion module is shown below.

Pin layout (Front view of the module)	Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name
	2B20	No connect*6	2A20	No connect*6	1B20	HB*2, *3, *4	1A20	5 V*8
	2B19		2A19		1B19	HA*2, *3, *4	1A19	5 V*8
	2B18		2A18		1B18	HBL*2, *3, *5	1A18	HBH*2, *3, *5
	2B17		2A17		1B17	HAL*2, *3, *5	1A17	HAH*2, *3, *5
	2B16		2A16		1B16	No connect*6	1A16	No connect*6
	2B15		2A15		1B15	5 V*9	1A15	5 V*9
	2B14		2A14		1B14	SG*9	1A14	SG*9
	2B13		2A13		1B13	No connect*6	1A13	No connect*6
	2B12		2A12		1B12		1A12	
	2B11		2A11		1B11		1A11	
	2B10		2A10		1B10		1A10	
	2B9		2A9		1B9		1A9	
	2B8		2A8		1B8	EMI. COM	1A8	EMI
	2B7	COM	2A7	COM	1B7	COM	1A7	COM
	2B6	COM	2A6	COM	1B6	COM	1A6	COM
	2B5	SIN20*7	2A5	SIN15*7	1B5	SIN10*7	1A5	SIN5*7
	2B4	SIN19*7	2A4	SIN14*7	1B4	SIN9*7	1A4	SIN4*7
	2B3	SIN18*7	2A3	SIN13*7	1B3	SIN8*7	1A3	SIN3*7
	2B2	SIN17*7	2A2	SIN12*7	1B2	SIN7*7	1A2	SIN2*7
	2B1	SIN16*7	2A1	SIN11*7	1B1	SIN6*7	1A1	SIN1*7

*1 RD77MS2 does not have the connector of 2A20 to 2A1 and 2B20 to 2B1.

*2 Input type from manual pulse generator/incremental synchronous encoder is switched in "[Pr.89] Manual pulse generator/Incremental synchronous encoder input type selection". (Only the value specified against the axis 1 is valid.)
- 0: Differential-output type
- 1: Voltage-output/open-collector type (Default value)

*3 Set the signal input form in "[Pr.24] Manual pulse generator/Incremental synchronous encoder input selection".

*4 Voltage-output/open-collector type
Connect the A-phase/PULSE signal to HA, and the B-phase/SIGN signal to HB.

*5 Differential-output type
Connect the A-phase/PULSE signal to HAH, and the A-phase/PULSE inverse signal to HAL.
Connect the B-phase/SIGN signal to HBH, and the B-phase/SIGN inverse signal to HBL.

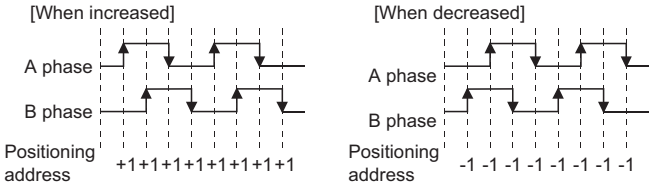
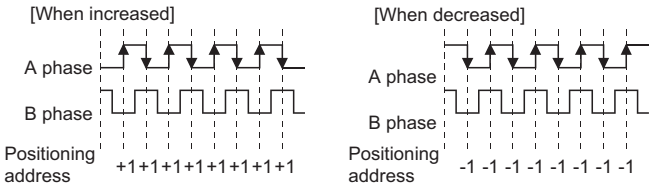
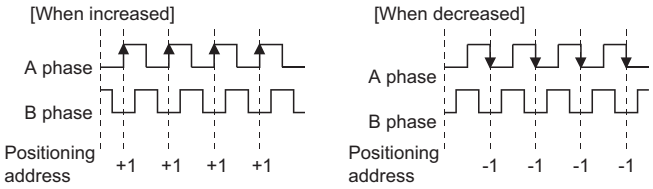
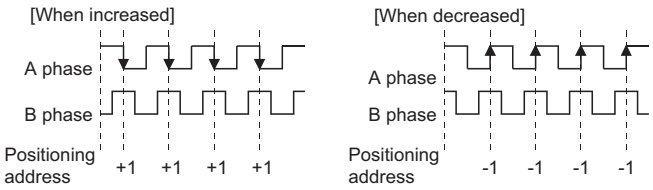
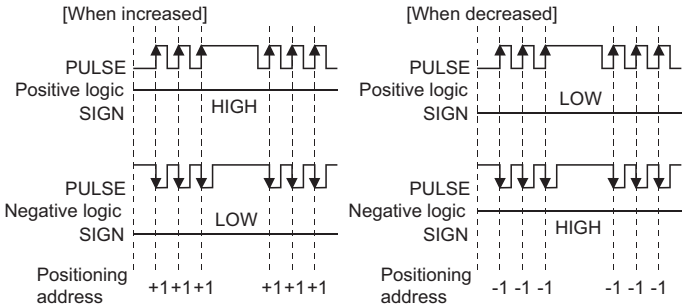
*6 Do not connect to any terminals explained as "No connect".

*7 Set the external command signal [DI, FLS, RLS, DOG, STOP] in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", "[Pr.118] DOG signal selection", "[Pr.119] STOP signal selection" and "[Pr.95] External command signal selection".

*8 Do not connect wires other than the signal wires of the manual pulse generator to 1A20 and 1A19.

*9 Do not use 1A(B)15 and 1A(B)14 for other than the power supply of manual pulse generator.

List of input signal details

Signal name			Pin No.	Signal details
Differential-output type	Manual pulse generator/ Incremental synchronous encoder A phase/PULSE	HAH (A+)	1A17	(1) Phase A/Phase B • Input the pulse signal from the manual pulse generator/incremental synchronous encoder A phase and B phase. • If the A phase leads the B phase, the positioning address will increase at the rising and falling edges of each phase. • If the B phase leads the A phase, the positioning address will decrease at the rising and falling edges of each phase. (a) Magnification by 4  (b) Magnification by 2  (c) Magnification by 1 1) Positive logic  2) Negative logic 
		HBH (B+)	1A18	
		HBL (B-)	1B18	
Voltage-output/ open-collector type	Manual pulse generator/ Incremental synchronous encoder A phase/PULSE	HA (A)	1B19	(2) PULSE/SIGN Input the pulse signal for counting the increased/decreased pulse in the pulse input (PULSE). Input the signal for controlling forward run and reverse run in the direction sign (SIGN). 1) "[Pr.151] Manual pulse generator/Incremental synchronous encoder input logic selection" is positive logic • The motor will forward run when the direction sign is HIGH. • The motor will reverse run when the direction sign is LOW. 2) "[Pr.151] Manual pulse generator/Incremental synchronous encoder input logic selection" is negative logic • The motor will forward run when the direction sign is LOW. • The motor will reverse run when the direction sign is HIGH. 
	Manual pulse generator/ Incremental synchronous encoder B phase/SIGN	HB (B)	1B20	

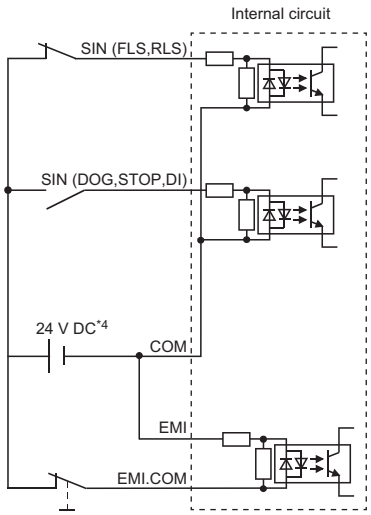
Signal name	Pin No.	Signal details	
Manual pulse generator power supply output (+ 5 V DC) (5 V)	1A20 1A19	• Power supply for manual pulse generator. (+ 5 V DC) Do not connect wires other than the signal wires of the manual pulse generator.	
Input signal (SIN)	1A1 to 1A5, 1B1 to 1B5, 2A1 to 2A5, 2B1 to 2B5	Upper limit signal (FLS)	• This signal is input from the limit switch installed at the upper limit position of the stroke. • Positioning will stop when this signal turns OFF. • When the home position return retry function is valid, this will be the upper limit for finding the near-point dog signal.
		Lower limit signal (RLS)	• This signal is input from the limit switch installed at the lower limit position of the stroke. • Positioning will stop when this signal turns OFF. • When the home position return retry function is valid, this will be the lower limit for finding the near-point dog signal.
		Near-point dog signal (DOG)	• This signal is used for detecting the near-point dog during the home position return. • The near-point dog OFF → ON is detected at the rising edge. • The near-point dog ON → OFF is detected at the falling edge.
		Stop signal (STOP)	• Input this signal to stop positioning. • When this signal turns ON, the RD77MS will stop the positioning being executed. After that, even if this signal is turned from ON to OFF, the system will not start.
		External command/ Switching signal (DI)	• Input a control switching signal during speed-position or position-speed switching control. • Use this signal as the input signal of positioning start, speed change request, skip request and mark detection from an external device. Set the function to use this signal in "[Pr.42] External command function selection". Set the signal in "[Pr.95] External command signal selection".
Common (COM)	1A6 1A7 1B6 1B7 2A6 2A7 2B6 2B7	• Common for upper/lower limit, near-point dog, stop, and external command/switching signals.	
Forced stop input signal (EMI)	1A8	• This signal is input when batch forced stop is available for all axes of servo amplifier. EMI ON (Opened): Forced stop EMI OFF (24 V DC input): Forced stop release	
Forced stop input signal common (EMI.COM)	1B8		
Manual pulse generator power supply output (+ 5 V DC) (5 V)	1A15 1B15	• Power supply for manual pulse generator (+ 5 V DC) This power supply is used for manual pulse generator. It must not be used except for the manual pulse generator power supply.	
Manual pulse generator power supply output (GND) (SG)	1A14 1B14	• Power supply for manual pulse generator (GND) This power supply is used for manual pulse generator. It must not be used except for the manual pulse generator power supply.	

*1 There are no signals of 2A_ and 2B_ at RD77MS2 use.

Interface internal circuit

The outline diagrams of the internal circuits for the external device connection interface (for the Simple Motion module, axis 1) are shown below.

Interface between external input signals/forced stop input signals

Input or Output	Signal name		Pin No.	Wiring example	Description
Input	External input signal[*1] (Upper/Lower limit signal[*2])	SIN (FLS, RLS)	_ _1 to 5[*3]		Upper-limit signal, Lower-limit signal, Near-point dog signal, Stop signal, External command signal, Switching signal, Forced stop input signal
	External input signal[*1] (Near-point dog[*2], Stop, External command/Switching signal)	SIN (DOG, STOP, DI)			
	Common	COM	_ _6[*3]		
			_ _7[*3]		
	Forced stop input signal	EMI	1A8		
		EMI.COM	1B8		

*1 When using external input signal of servo amplifier, set "1" with "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", and "[Pr.118] DOG signal selection".

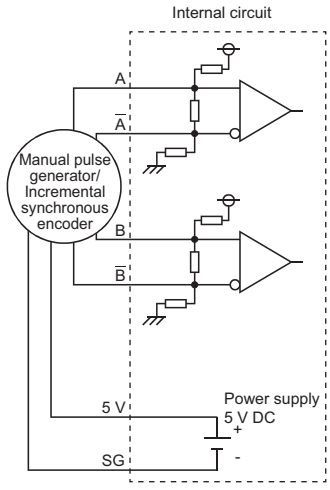
*2 Refer each servo amplifier instruction manual for wiring of the input/output signals of servo amplifier.

*3 "_ _" indicates "1A", "1B", 2A ", or "2B".

*4 As for the 24 V DC sign, both "+" and "-" are possible.

Manual pulse generator/Incremental synchronous encoder input

■Interface between manual pulse generator/incremental synchronous encoder (Differential-output type)

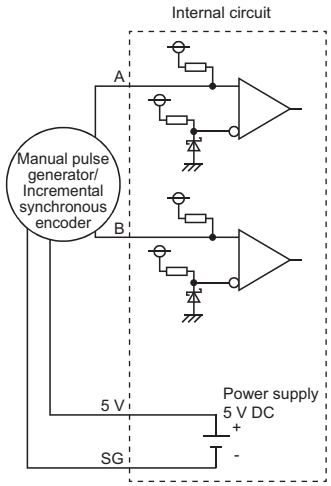
Input or Output	Signal name		Pin No.	Wiring example
Input[*1,*2]	Manual pulse generator, phase A/PULSE	HAH (A+)	1A17	
		HAL (A-)	1B17	
	Manual pulse generator, phase B/SIGN	HBH (B+)	1B17	
		HBL (B-)	1B18	
Power supply	5 V[*3]		1A15 1B15	
	SG		1A14 1B14	

*1 Set "0: Differential-output type" in "[Pr.89] Manual pulse generator/Incremental synchronous encoder input type selection" if the manual pulse generator/Incremental synchronous encoder of differential-output type is used.
The default value is "1: Voltage-output/open-collector type".

*2 Set the signal input form in "[Pr.24] Manual pulse generator/Incremental synchronous encoder input selection".

*3 The 5 V DC power supply from the Simple Motion module must not be used if a separate power supply is applied to the manual pulse generator/incremental synchronous encoder. If a separate power supply is used, use a stabilized power supply of voltage 5 V DC. Anything else may cause a failure.

■Interface between manual pulse generator/Incremental synchronous encoder (Voltage-output/open-collector type)

Input or Output	Signal name		Pin No.	Wiring example
Input[*1, *2]	Manual pulse generator, phase A/PULSE	HA (A)	1B19	
	Manual pulse generator, phase B/SIGN	HB (B)	1B20	
Power supply	5 V[*3]		1A15 1B15	
	SG		1A14 1B14	

*1 Set "1: Voltage-output/open-collector type" in "[Pr.89] Manual pulse generator/Incremental synchronous encoder input type selection" if the manual pulse generator/Incremental synchronous encoder of voltage-output/open-collector type is used.
The default value is "1: Voltage-output/open-collector type".

*2 Set the signal input form in "[Pr.24] Manual pulse generator/Incremental synchronous encoder input selection".

*3 The 5 V DC power supply from the Simple Motion module must not be used if a separate power supply is applied to the manual pulse generator/Incremental synchronous encoder. If a separate power supply is used, use a stabilized power supply of voltage 5 V DC. Anything else may cause a failure.

Wiring example for manual pulse generator/incremental synchronous encoder

Wire the manual pulse generator/incremental synchronous encoder of differential output type and voltage output type as follows.

Switch the input type of RD77MS by "[Pr.89] Manual pulse generator/Incremental synchronous encoder input type selection".

It is recommended to use the external 5 V power supply (5 V DC±5%) for the power supply of the manual pulse generator/incremental synchronous encoder. When using the external power supply, do not connect with the 5 V terminal of RD77MS.

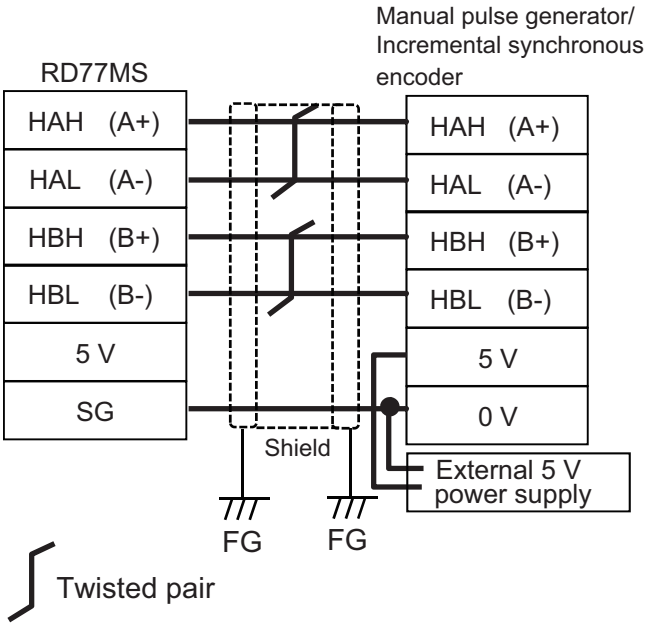
When using the internal power supply, connect the 5 V terminal of RD77MS and the 5 V (+) of the manual pulse generator/incremental synchronous encoder.

In either case, connect the 0 V (-) of the manual pulse generator/incremental synchronous encoder and the SG of RD77MS.

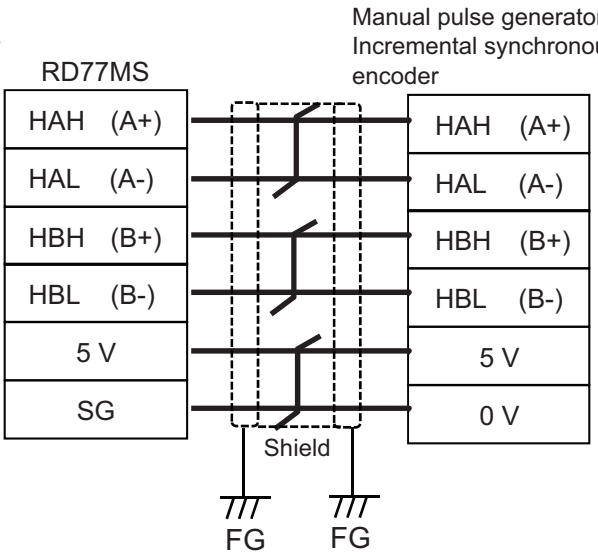
Do not use the 5 V terminal of RD77MS except for connecting the manual pulse generator/incremental synchronous encoder. It may cause a failure. Also, do not connect the manual pulse generator/incremental synchronous encoder whose current consumption exceeds 200 mA.

■Manual pulse generator/Incremental synchronous encoder of differential output type

When using the external power supply (Recommended)

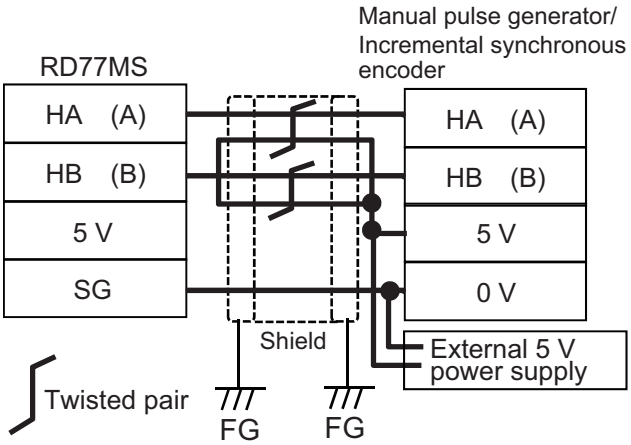


When using the internal power supply

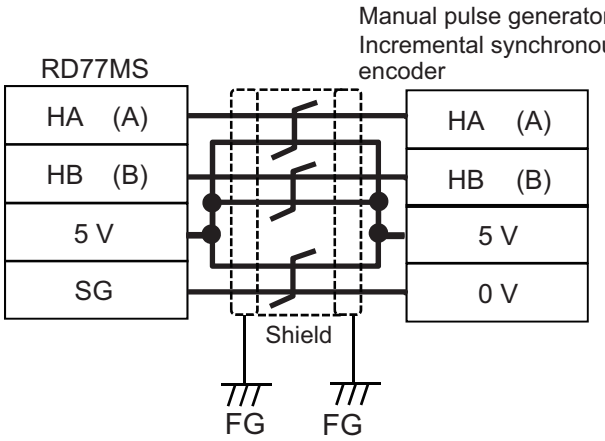


■Manual pulse generator/Incremental synchronous encoder of voltage output type

When using the external power supply (Recommended)



When using the internal power supply



6 OPERATION EXAMPLES

This chapter describes the programming procedure and the basic program of the RD77. When applying the program examples provided in this manual to an actual system, properly verify the applicability and reliability of the control on the system.

Overall configuration

The program examples show the programs of the following operations.

- Machine home position return execution
- Execution of 1-axis linear control using axis 1
- JOG operation execution

The following table shows the overall configuration of the positioning control operation examples. Note that the programs in the list are the ones using the axis 1 only.

No.	Program name	Description
1	PLC READY signal [Y0] ON program	Notifies the RD77 that the CPU module is normal before the start of positioning control.
2	All axis servo ON program	Enables the servo amplifier to operate.
3	Positioning start No. setting program	Sets the positioning data that are executed with a positioning start program. The operation example is the case when the start No. is for machine home position return or the positioning data No.1 of the axis 1 is used.
4	Positioning start program	Starts the machine home position return or the positioning control using positioning data.
5	JOG operation setting program	Sets the JOG operation speed.
6	JOG operation execution program	Starts the JOG operation.

Programming procedure

Take the following steps to create a program for the motion control:

1. Set the system structure setting and parameter setting of the Simple Motion module setting for the initial setting.

☞ Page 51 System setting, Page 52 Parameters

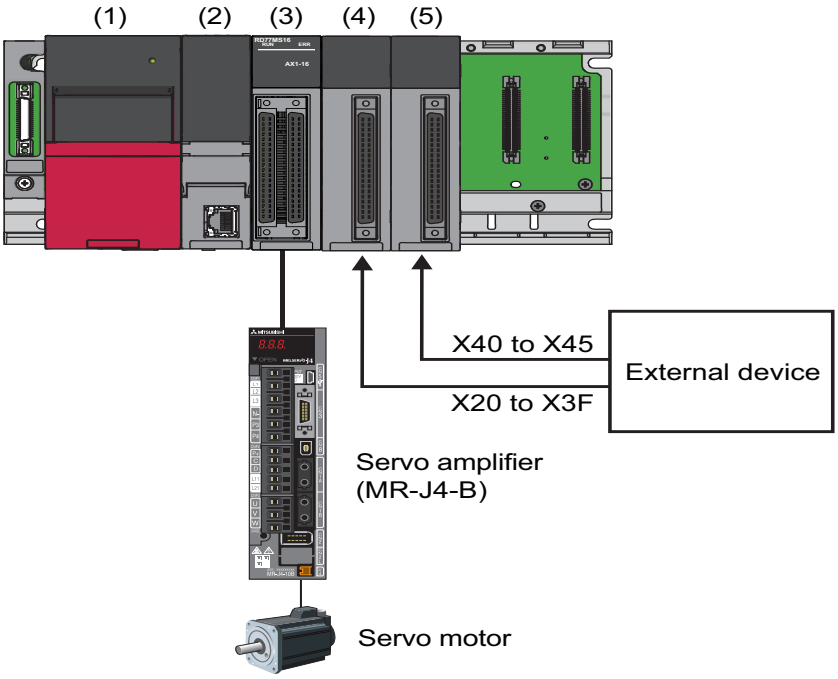
2. Set the positioning data of the Simple Motion module setting.

☞ Page 52 Positioning data

3. Program examples of each control

System configuration

The following figure shows the system configuration used for the program examples in this section.



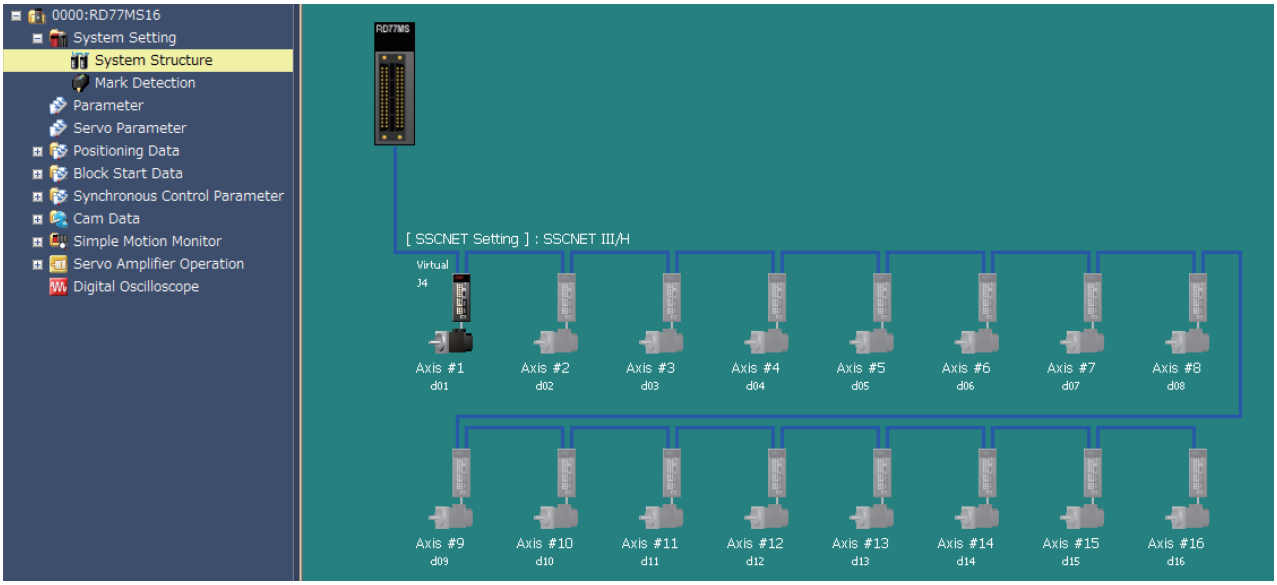
(1) R61P
(2) R16CPU
(3) RD77MS16 (X0 to X1F/Y0 to Y1F)
(4) RX40C7 (X20 to X3F)
(5) RX40C7 (X40 to X5F)

Initial setting details

Set the system setting, parameters and positioning data using the engineering tool.

■System setting

The system setting is shown below.



■Parameters

The following table lists parameters. Use the default values for the setting items not listed here or the setting items for the axes not described here.

Setting item		Setting value (Axis 1)
Common parameters	[Pr.82] Forced stop valid/invalid selection	1: Invalid
Basic parameters 1	[Pr.1] Unit setting	0: mm
	[Pr.2] Number of pulses per rotation	4194304 pulses
	[Pr.3] Movement amount per rotation	250000.0 μm
Detailed parameters 1	[Pr.22] Input signal logic selection: Lower limit	1: Positive logic
	[Pr.22] Input signal logic selection: Upper limit	1: Positive logic
	[Pr.116] FLS signal selection: input type	2: Buffer memory
	[Pr.117] RLS signal selection: input type	2: Buffer memory
	[Pr.118] DOG signal selection: input type	2: Buffer memory
Home position return basic parameters	[Pr.46] Home position return speed	50.00 mm/min
	[Pr.47] Creep speed	15.00 mm/min
	[Pr.48] Home position return retry	1: Retry home position return with limit switch

■Positioning data

The following table lists positioning data. Use the default values for the setting items not listed here or the setting items for the axes not described here.

Setting item (Axis 1 Positioning data)	Setting value (Positioning data No.1)	Setting value (Positioning data No.2)	Setting value (Positioning data No.3)
Operation pattern	0: Positioning complete		
Control system	01h: ABS Linear 1 1-axis linear control (ABS)	06h: FWD V/P Speed-position switching control (forward run)	08h: FWD P/V Position-speed switching control (forward run)
Axis to be interpolated	—		
Acceleration time No.	0: 1000		
Deceleration time No.	0: 1000		
Positioning address	-10000.0 μm	2500.0 μm	2000.0 μm
Arc address	—		
Command speed	20.00 mm/min	180.00 mm/min	180.00 mm/min
Dwell time	300 ms	0 ms	300 ms
M code	9843	0	0
M code ON signal output timing	0: Use the setting value of M code ON signal output timing		
ABS direction in degrees	0: Use the setting value of ABS direction setting at degree		
Interpolation speed designation method	0: Use the setting value of interpolation speed designation method		

List of labels to be used

The following table lists the labels used for the program examples in this section. I/O signals or buffer memory areas of the modules shown in the system configuration are described in the programs using the labels.

For details on the global labels, refer to the following.

MELSEC iQ-R Programming Manual (Program Design)

■Module label

The following table lists the module labels of the RD77 used for the program examples in this section.

Device name	Device	Label name	Signal name
	Axis 1		
I/O signals of the RD77	X1	RD77_1.bSynchronizationFlag	Synchronization flag
	DX1	RD77_1.bSynchronizationFlag_D	Synchronization flag
	Y0	RD77_1.bPLC_Ready	PLC READY
	Y1	RD77_1.bAllAxisServoOn	All axis servo ON
Buffer memory of the RD77	U0\G2417.3	RD77_1.stnAxMntr_D[0].uStatus_D.3	Axis 1 Home position return request flag
	U0\G2417.D	RD77_1.stnAxMntr_D[0].uStatus_D.D	Axis 1 Start complete
	U0\G2417.F	RD77_1.stnAxMntr_D[0].uStatus_D.F	Axis 1 Positioning complete
	U0\G4328	RD77_1.stnAxCtrl1_D[0].udPV_NewSpeed_D	Axis 1 Speed-position switching enable flag
	U0\G4330	RD77_1.stnAxCtrl1_D[0].uEnablePV_Switching_D	Axis 1 Position-speed switching control speed change register
	U0\G4332	RD77_1.stnAxCtrl1_D[0].uEnableVP_Switching_D	Axis 1 Position-speed switching enable flag

■Global label

The following table lists the global labels, which are created by a user if necessary, used for the program examples in this section. Set the following in the global label of the engineering tool.

Device name	Setting details				Application
	Label name	Data type	Class	Assign (Device/Label)	
External input (command)	bInputOPRStartReq	Bit	VAR_GLOBAL	X23	Machine home position return command
	bInputFastOPRStartReq			X24	Fast home position return command
	bInputSetStartPositioningNoReq			X25	Positioning start No. setting command
	bInputSpeedPositionSwitchingReq			X26	Speed-position switching operation command
	bInputSpeedPositionSwitchingEnableReq			X27	Speed-position switching enable command
	bInputSpeedPositionSwitchingDisableReq			X28	Speed-position switching prohibit command
	bInputStartAdvancedPositioningReq			X2A	High-level positioning control start command
	bInputStartPositioningReq			X2B	Positioning start command
	bInputSetJogSpeedReq			X2D	JOG operation speed setting command
	bInputForwardJogStartReq			X2E	Forward run JOG
	bInputReverseJogStartReq			X2F	Reverse run JOG
	bInputPositionSpeedSwitchingReq			X40	Position-speed switching operation command
	bInputPositionSpeedSwitchingEnableReq			X41	Position-speed switching enable command
	bInputPositionSpeedSwitchingDisableReq			X42	Position-speed switching prohibit command
	bInputChangePositionSpeedSwitchingSpeedReq			X43	Speed change command
	bAllAxisServoOnReq			X4F	All axis servo ON command

Device name	Setting details				Application
	Label name	Data type	Class	Assign (Device/Label)	
Internal relay, data device*1	bABRSTReq	Bit	VAR_GLOBAL	—	Absolute position restoration command
	bBasicParamSetComp				Basic parameter 1 setting complete
	bDuringJogInchingOperation				In-JOG/Inching operation flag
	bDuringMPGOperation				Manual pulse generator operating flag
	bFastOPRStartReq				Fast home position return command
	bFastOPRStartReq_H				Fast home position return command storage
	bInitializeParameterReq				Parameter initialization command
	bJOG_bENO				Execution status (JOG/Inching FB)
	bJOG_bErr				Error completion (JOG/Inching FB)
	bJOG_bOK				Normal termination (JOG/Inching FB)
	bOPRParamSetComp				Home position return basic parameter setting complete
	bPositioningStartReq				Positioning start command
	bStartPositioning_bENO				Execution status (Positioning start FB)
	bStartPositioning_bErr				Error completion (Positioning start FB)
	bStartPositioning_bOK				Normal termination (Positioning start FB)
	bWriteFlashReq				Flash ROM write command
	udJogOperationSpeed	Double Word [Unsigned]/ Bit String [32-bit]			JOG operation speed
	udMovementAmount				Speed-position switching control movement amount
	udSpeed	Double Word [Signed]			Position-speed switching control speed
	uInchingMovementAmount	Double Word [Unsigned]/ Bit String [32-bit]			Inching movement amount
	uJOG_uErrId				Error code (JOG/Inching FB)
	uPositioningStartNo				Positioning start No.
	uStartPositioning_uErrId				Error code (Positioning start FB)

*1 The settings of Assign (Device/Label) are not required because the unused internal relay and data device are automatically assigned.

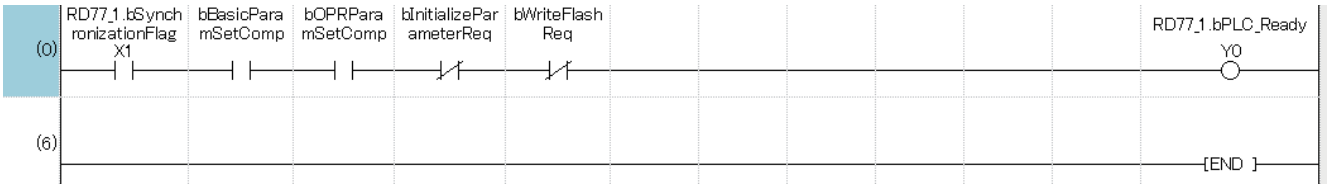
Program example

The program examples use the module function blocks (FBs) and module labels displayed in "Module POU".

For details on module function blocks, refer to the following.

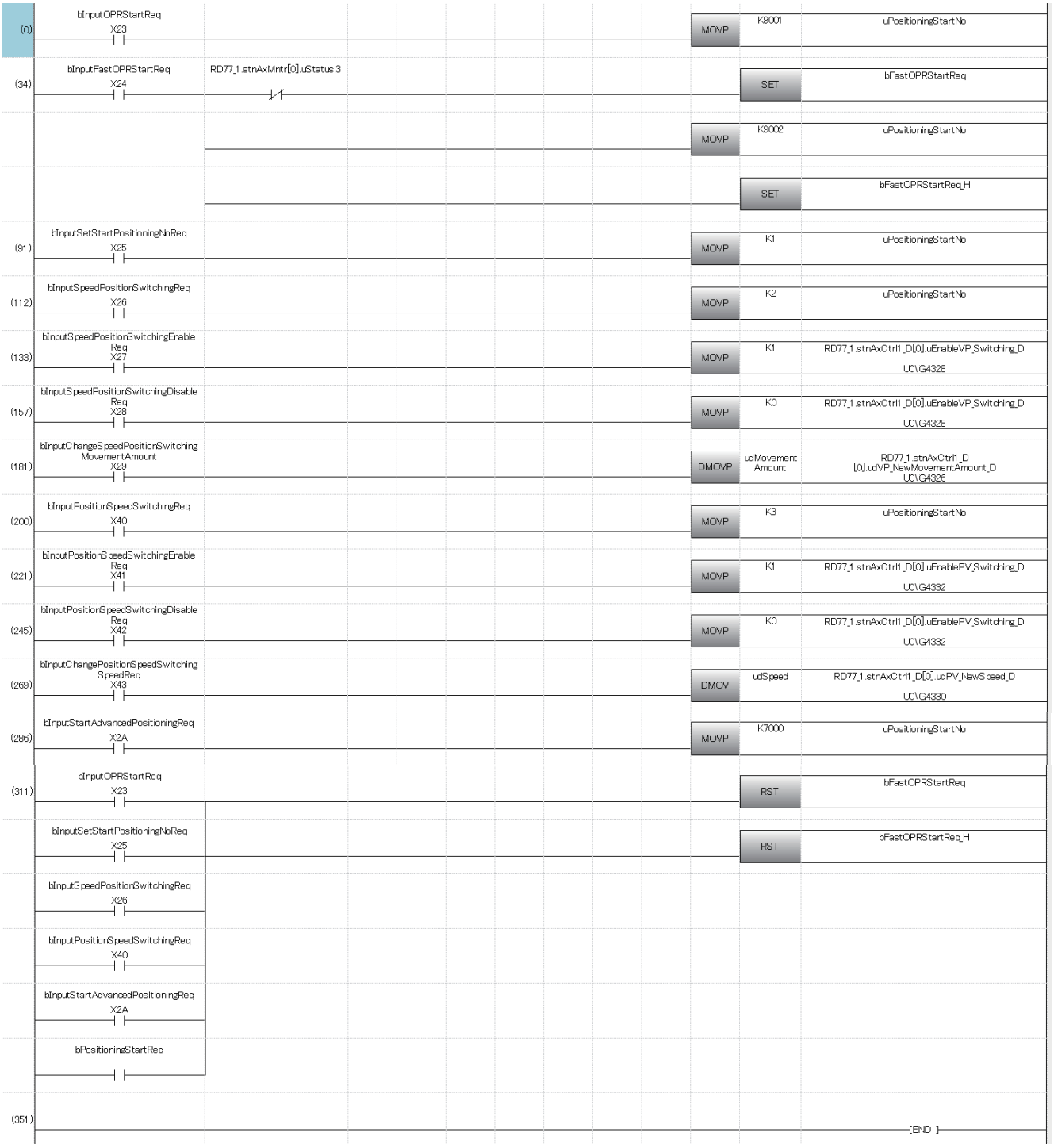
MELSEC iQ-R Simple Motion Module Function Block Reference

■PLC READY signal [Y0] ON program

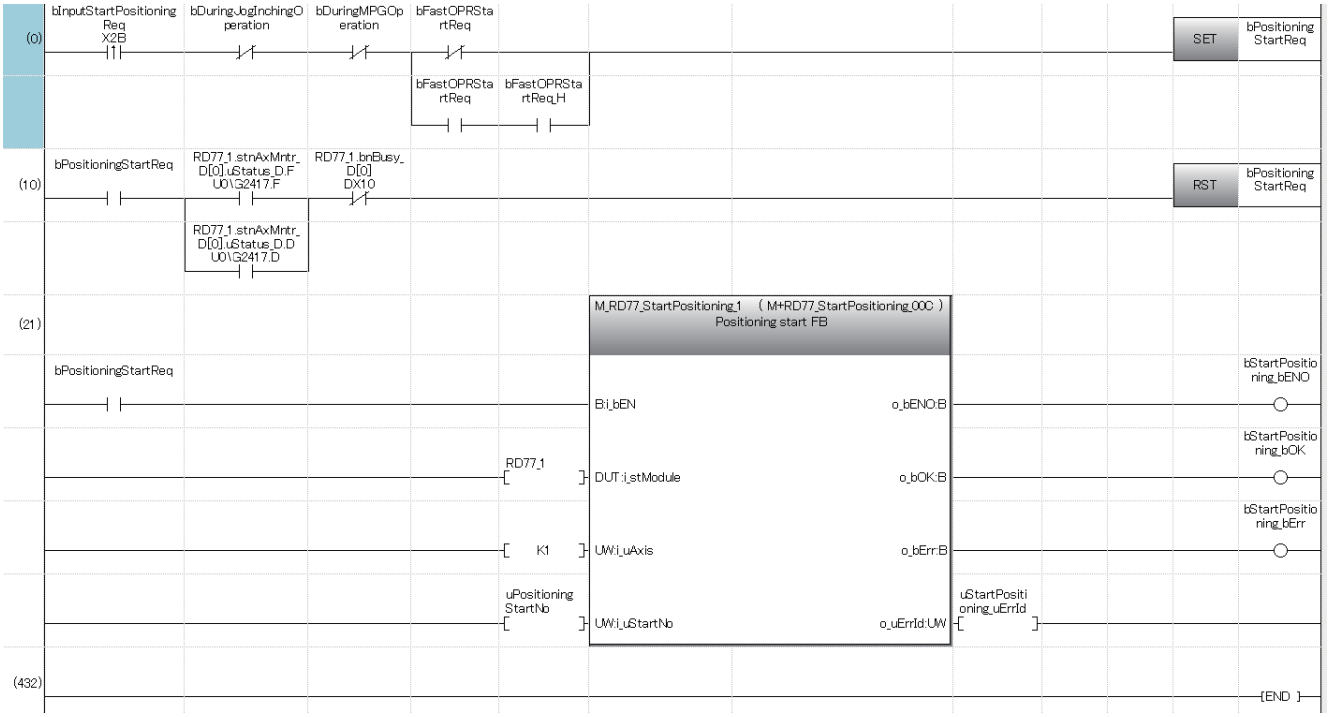


■All axis servo ON signal [Y1] ON program

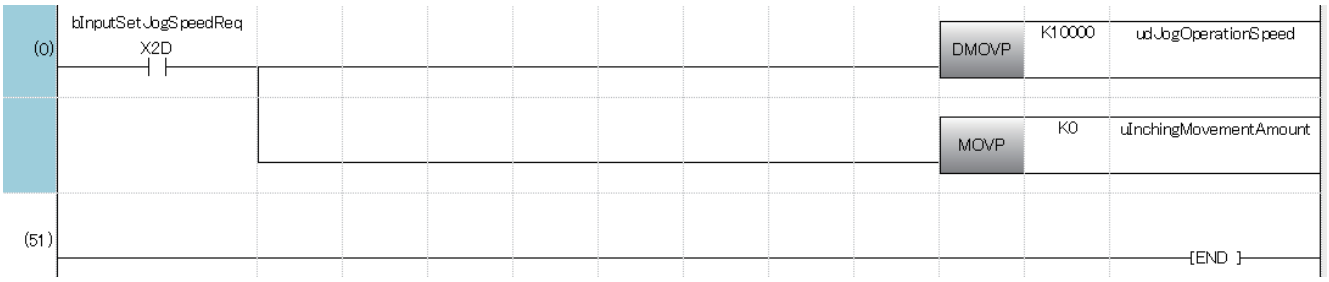
■Positioning start No. setting program



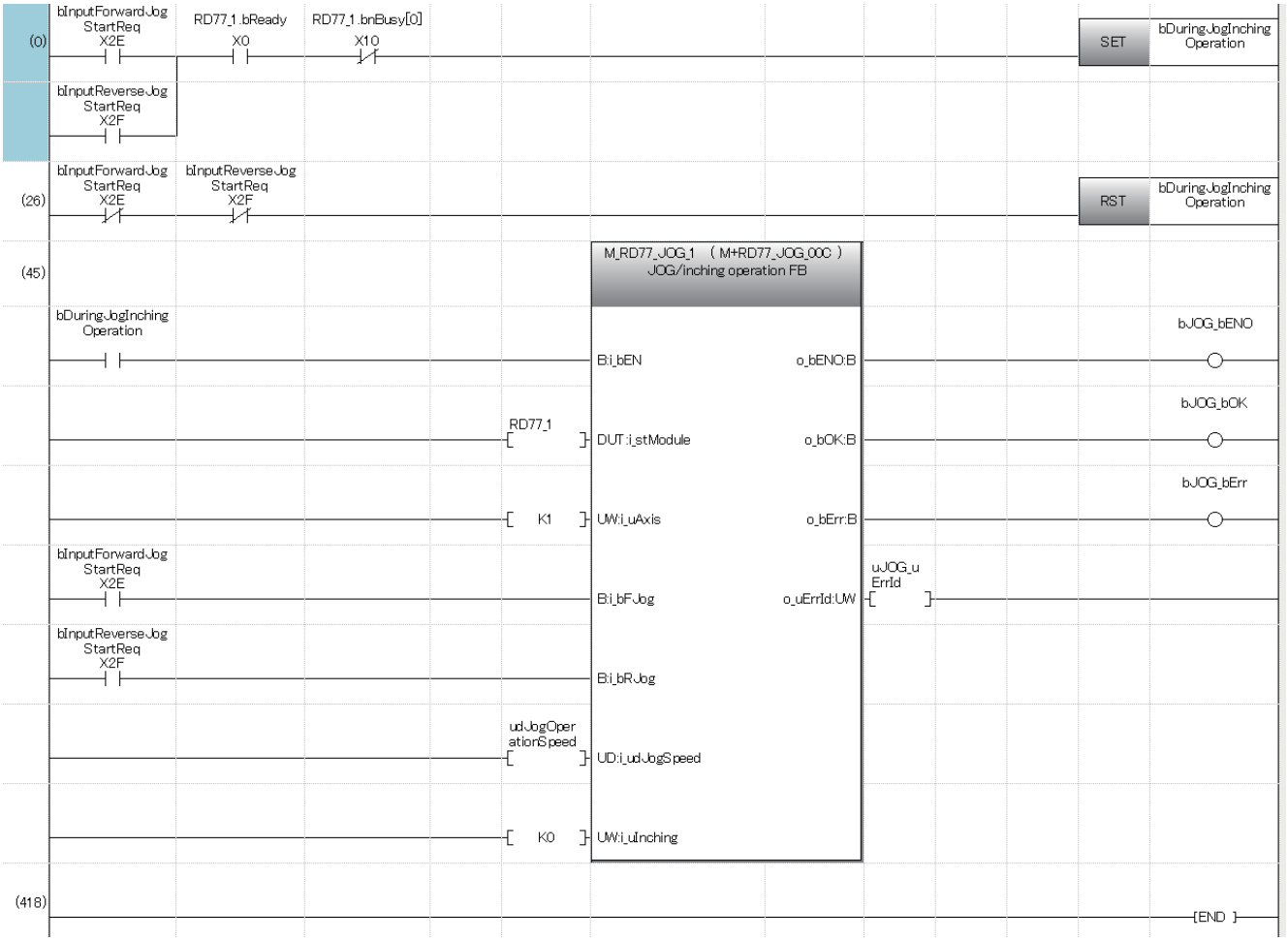
■Positioning start program



■JOG operation setting program



■JOG operation execution program



APPENDICES

Appendix 1 Component List

The positioning system using the Simple Motion module is configured of the following devices.

No.	Part name	Type	Remarks
1	Simple Motion module	RD77MS2	RD77MS□ Number of control axes MS: SSCNETⅢ(/H) model
		RD77MS4	
		RD77MS8	
		RD77MS16	
2	Servo amplifier	—	—
3	Manual pulse generator	—	Recommended: MR-HDP01 (Manufactured by Mitsubishi Electric Corporation) Operation has been checked: UFO-M2-0025-2Z1-B00E (Manufactured by Nemicon Corporation) RE45BA2R5C (Manufactured by Tokyo Sokuteikizai Co., Ltd.)
4	SSCNETⅢ cable	—	Cables are needed for connecting the Simple Motion module with a servo amplifier, or between servo amplifiers. (☞ Page 58 Reference product)
5	External input signal cable	—	Cables are needed for connecting the Simple Motion module with an external device. (Prepare them referring to the manuals for the connected devices and information given in the following. ☞ Page 44 Signal layout for external input connection connector)

Reference product

Connection cable

The cables for connecting between the Simple Motion module and servo amplifiers. Refer to each servo amplifier instruction manual for details.

[SSCNETⅢ cable]

_ = Cable length

(015: 0.15 m (0.49 ft.), 03: 0.3 m (0.98 ft.), 05: 0.5 m (1.64 ft.), 1: 1 m (3.28 ft.), 3: 3 m (9.84 ft.), 5: 5 m (16.40 ft.), 10: 10 m (32.81 ft.), 20: 20 m (65.62 ft.), 30: 30 m (98.43 ft.), 40: 40 m (131.23 ft.), 50: 50 m (164.04 ft.))

Model name		Cable length [m (ft.)]	Description
MR-J3BUS_M (Standard cord for inside panel)	MR-J3BUS015M	0.15 (0.49)	• Simple Motion module ↔ MR-J4(W)-B/MR-J3(W)-B • MR-J4(W)-B/MR-J3(W)-B ↔ MR-J4(W)-B/MR-J3(W)-B
	MR-J3BUS03M	0.3 (0.98)	
	MR-J3BUS05M	0.5 (1.64)	
	MR-J3BUS1M	1 (3.28)	
	MR-J3BUS3M	3 (9.84)	
MR-J3BUS_M-A (Standard cable for outside panel)	MR-J3BUS5M-A	5 (16.40)	
	MR-J3BUS10M-A	10 (32.81)	
	MR-J3BUS20M-A	20 (65.62)	
MR-J3BUS_M-B (Long distance cable)	MR-J3BUS30M-B	30 (98.43)	
	MR-J3BUS40M-B	40 (131.23)	
	MR-J3BUS50M-B	50 (164.04)	

Connection connector

The connector for the external input wiring.

[External input wiring connector]

Part name	Specification
Applicable connector	A6CON1, A6CON2, A6CON4 (Sold separately)
Applicable wire size	0.3 mm^2 (When A6CON1 and A6CON4 are used), 28 AWG to 24 AWG (When A6CON2 is used)

Specifications of recommended manual pulse generator

Item	Specification
Model name	MR-HDP01
Ambient temperature	-10 to 60℃ (14 to 140 ℉)
Pulse resolution	25 pulses/rev (100 pulses/rev after magnification by 4)
Output method	Voltage-output, Output current Max. 20 mA
Power supply voltage	4.5 to 13.2 V DC
Current consumption	60 mA
Output level	"H" level: Power supply voltage*1 - 1 V or more (in no load) "L" level: 0.5 V or less (with maximum leading-in)
Life time	1000000 revolutions (at 200 r/min)
Permitted axial loads	Radial load: Max. 19.6 N
	Thrust load: Max. 9.8 N
Weight	0.4 [kg]
Number of max. revolution	Instantaneous Max. 600 r/min. normal 200 r/min
Pulse signal status	2 signals: A phase, B phase, 90° phase difference
Start friction torque	0.06 N•m (20℃ (68℉))

*1 If a separate power supply is used, use a stabilized power supply of voltage 5 V DC ± 0.25 V.

Manual pulse generator that the operation has been checked

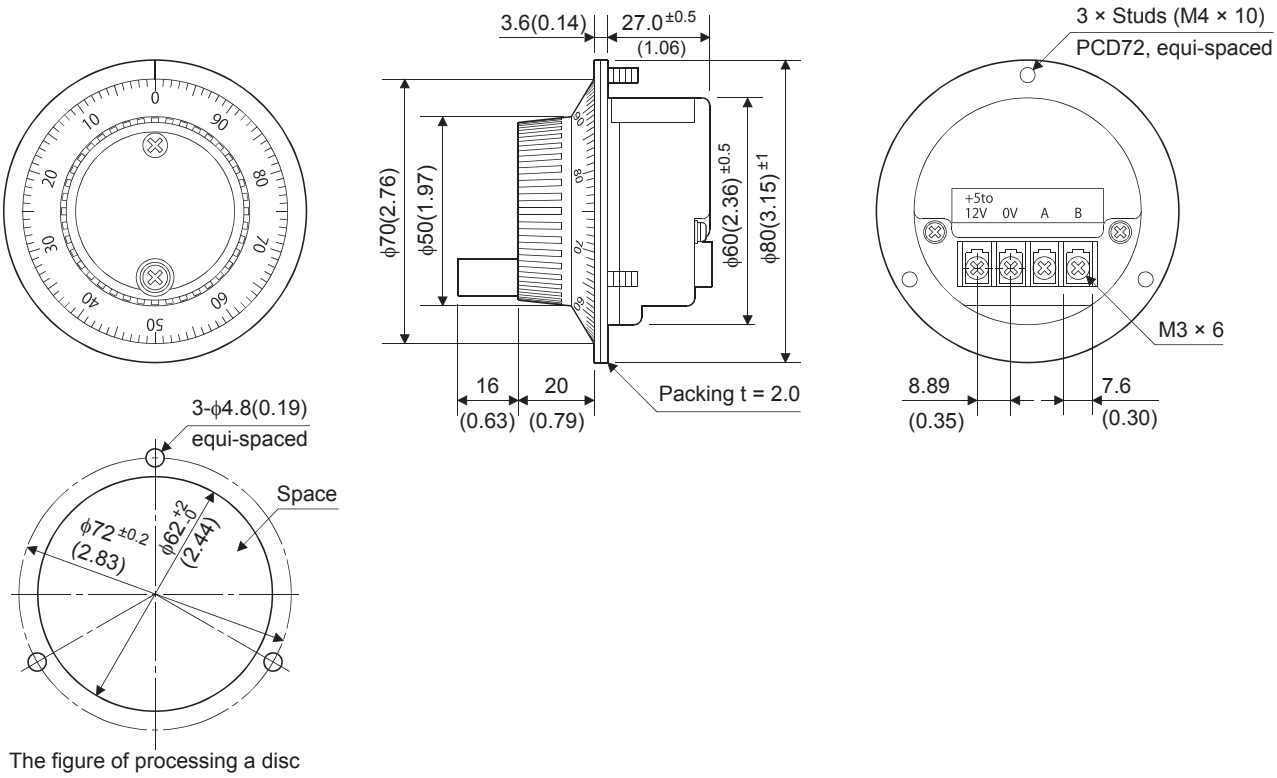
Manufacturer	Model name
Nemicon Corporation*1	UFO-M2-0025-2Z1-B00E
Tokyo Sokuteikizai Co., Ltd.*2	RE45BA2R5C

*1 Contact: http://www.nemicon.co.jp/nemicon/
*2 Contact: http://www.tosoku-inc.co.jp/

External dimension drawing of manual pulse generator

MR-HDP01 (Manufactured by Mitsubishi Electric Corporation)

[Unit: mm (inch)]



Serial absolute synchronous encoder specifications

Item	Specifications
Model name	Q171ENC-W8[*1]
Ambient temperature	-5 to 55℃ (23 to 131℉)
Resolution	4194304 pulses/rev
Transmission method	Serial communications (Connected to MR-J4-_B-RJ)
Direction of increasing addresses	CCW (viewed from end of shaft)
Protective construction	Dustproof/Waterproof (IP67: Except for the shaft-through portion.)
Permitted speed at power ON	3600 r/min
Permitted speed at power OFF[*2]	500 r/min
Permitted axial loads	Radial load: Up to 19.6 N, Thrust load: Up to 9.8 N
Runout at input shaft tip	0.02 mm (0.00079 inch) or less, (15 mm (0.59 inch) from tip)
Start friction torque	0.04 N•m (20℃ (68℉))
Recommended coupling	Bellows coupling
Permitted angular acceleration	40000 rad/s^2
Vibration resistance	5 G (50 to 200 Hz)
Shock resistance	50 G (11 ms or less)
Internal current consumption [A]	0.2
Mass [kg]	0.6
Connecting cable [m (ft.)]	Q170ENCCBL_M (_ = Cable length: 2 (6.56), 5 (16.40), 10 (32.81), 20 (65.62), 30 (98.43), 50 (164.04))
Communications method	Differential driver/receiver
Transmission distance	Up to 50 m (164.04 ft.)

*1 When "o-ring" is required, please purchase separately by a customer.

*2 If it exceeds a permitted speed at power OFF, a position displacement is generated.

Specifications of serial absolute synchronous encoder input (CN2L) of servo amplifier

Item	Specifications
Applicable types	Q171ENC-W8
Applicable signal types	Differential-output type: (SN75C1168 or equivalent)
Transmission method	Serial communications
Synchronous method	Counter-clock-wise (viewed from end of shaft)
Communication speed	2.5 Mbps
Position detection method	Absolute (ABS) method
Resolution	4194304 pulses/rev (22 bit)
Number of modules	1/module (MR-J4-_B-RJ)
External connector type	20 pin connector
Applicable connector for the external connection	MR-J3CN2 (Optional)
Applicable wire	J14B103715-00 12 pairs
Connecting cable [m (ft.)]	Q170ENCCBL_M-A (_ = Cable length: 2 (6.56), 5 (16.40), 10 (32.81), 20 (65.62), 30 (98.43), 50 (164.04))
Cable length	Up to 50 m (164.04 ft.)
Back up the absolute position.	Depends on the battery (MR-BAT6V1SET).
Battery service life time (value in actual)	10000 [h] (When MR-BAT6V1SET is used while the device is turned OFF at the ambient temperature of 25℃ (77℉))

Serial absolute synchronous encoder cable

Generally use the serial absolute synchronous encoder cables available as our products. If the required length is not found in our products, fabricate the cable by a customer side.

■Selection

The following table indicates the serial absolute synchronous encoder cables used with the serial absolute synchronous encoder. Connector sets (MR-J3CN2) are also available for your fabrication.

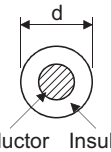
Cable model	Cable length [m (ft.)]	Wire model
Q170ENCCBL_M-A	2 (6.56), 5 (16.40), 10 (32.81), 20 (65.62), 30 (98.43), 50 (164.04)	J14B103715-00 12 pairs (BLACK)

Use the following or equivalent twisted pair cables as the serial absolute synchronous encoder cables.

Connector sets type	Description
MR-J3CN2	Servo amplifier connector

Wire model	Core size [mm^2]	Number of cores	Characteristics of one core			Finished OD [mm]*2
			Structure [Number of wires/ mm]	Conductor resistance [Ω/km]	Insulating sheath OD d [mm]*1	
J14B103715-00 12 pairs (BLACK)	0.2	24 (12 pairs)	40/0.08	105 or less	0.88	9.0

*1 d is as shown below.



Conductor Insulation sheath

*2 Standard OD (Outside Diameter). Maximum OD is about 10% larger.

⚠CAUTION

• When fabricating the encoder cable, do not make incorrect connection. Wrong connection will cause runaway or explosion.

■Q170ENCCBL_M-A

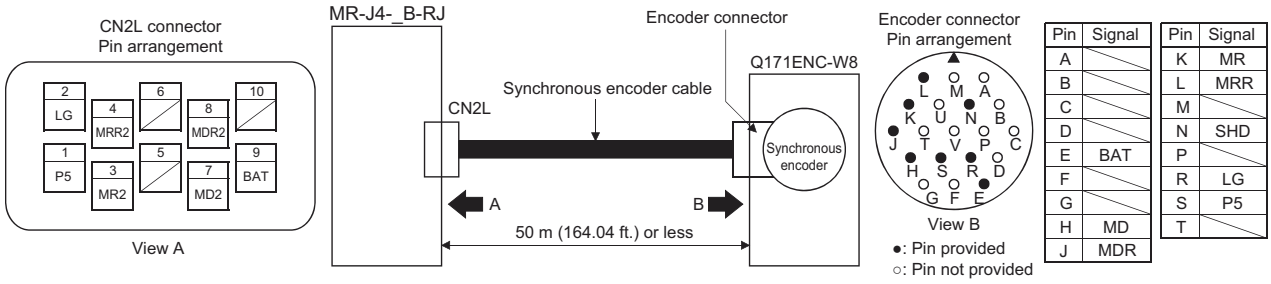
• Model explanation

Type: Q170ENCCBL_M - A

Symbol	Cable length [m (ft.)]
2	2 (6.56)
5	5 (16.40)
10	10 (32.81)
20	20 (65.62)
30	30 (98.43)
50	50 (164.04)

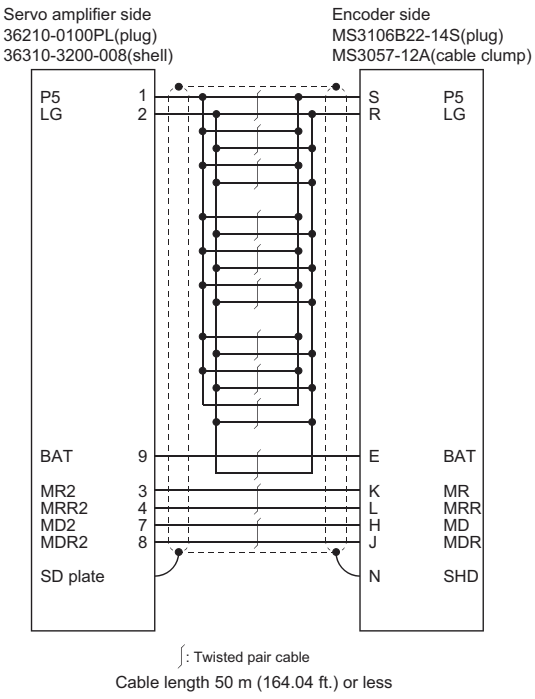
• Connection diagram

When fabricating a cable, use the recommended wire and connector set MR-J3CN2 for encoder cable given above, and make the cable as shown in the following connection diagram. Maximum cable length is 50 m (164.04 ft.).

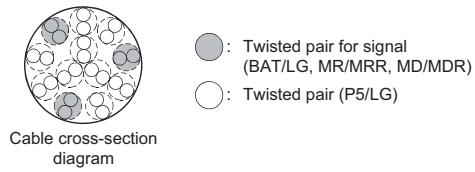


Pin	Signal
A	
B	
C	
D	
E	BAT
F	
G	
H	MD
J	MDR

Pin	Signal
K	MR
L	MRR
M	
N	SHD
P	
R	LG
S	P5
T	



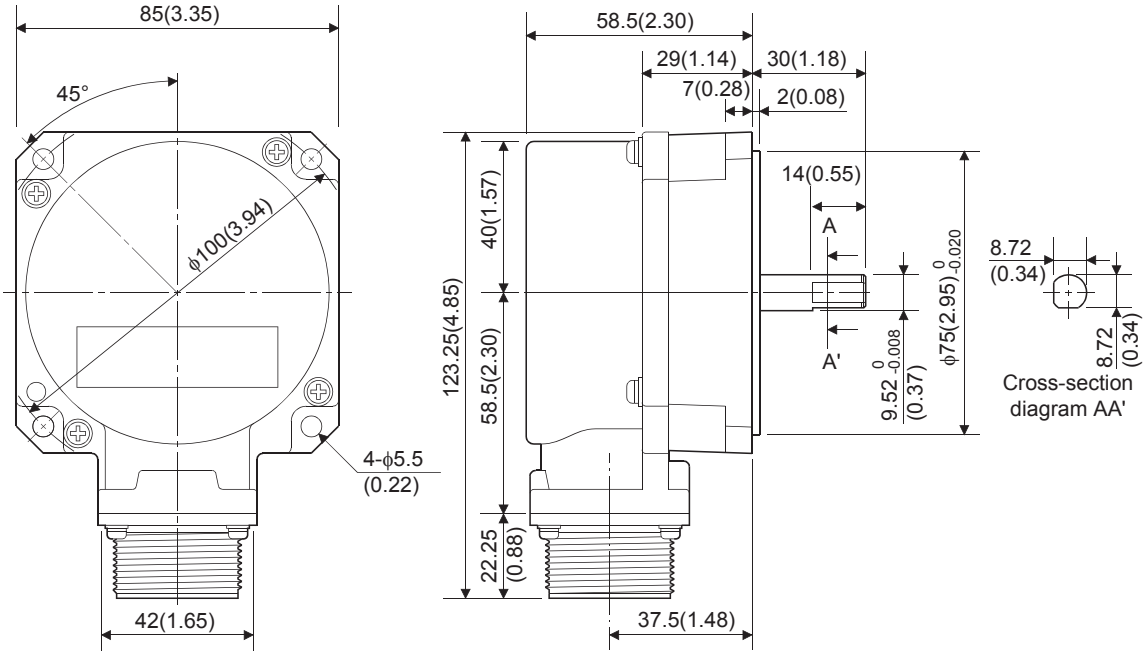
*: Layout twisted pair for signal to avoid contact.



External dimension drawing of serial absolute synchronous encoder

■Serial absolute synchronous encoder (Q171ENC-W8)

[Unit: mm (inch)]



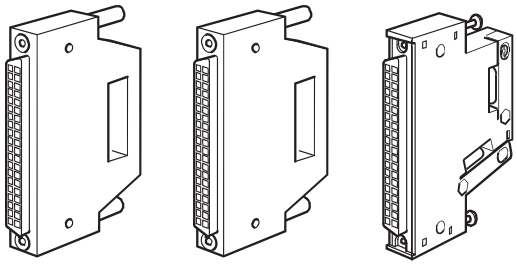
Appendix 2 Connection with External Devices

Connector

Mounted onto an external input signal connector of the RD77MS and used for wiring an external device. The "external device connector" includes the following 3 types.

Appearance

A6CON1 A6CON2 A6CON4



Connector type

Type	Model
	Connector
Soldering type, useable for straight out	A6CON1
Crimp-contact type, useable for straight out	A6CON2
Soldering type, useable for straight out and diagonal out	A6CON4

Specifications of the connector

Part name	Specification	
Applicable connector	A6CON1, A6CON4	A6CON2
Applicable wire size	0.3 mm^2	28 AWG to 24 AWG

*1 The external input signal connector has been prepared. Please purchase them by a customer.

Specialized tool

- Pressure-bonding tool for A6CON2

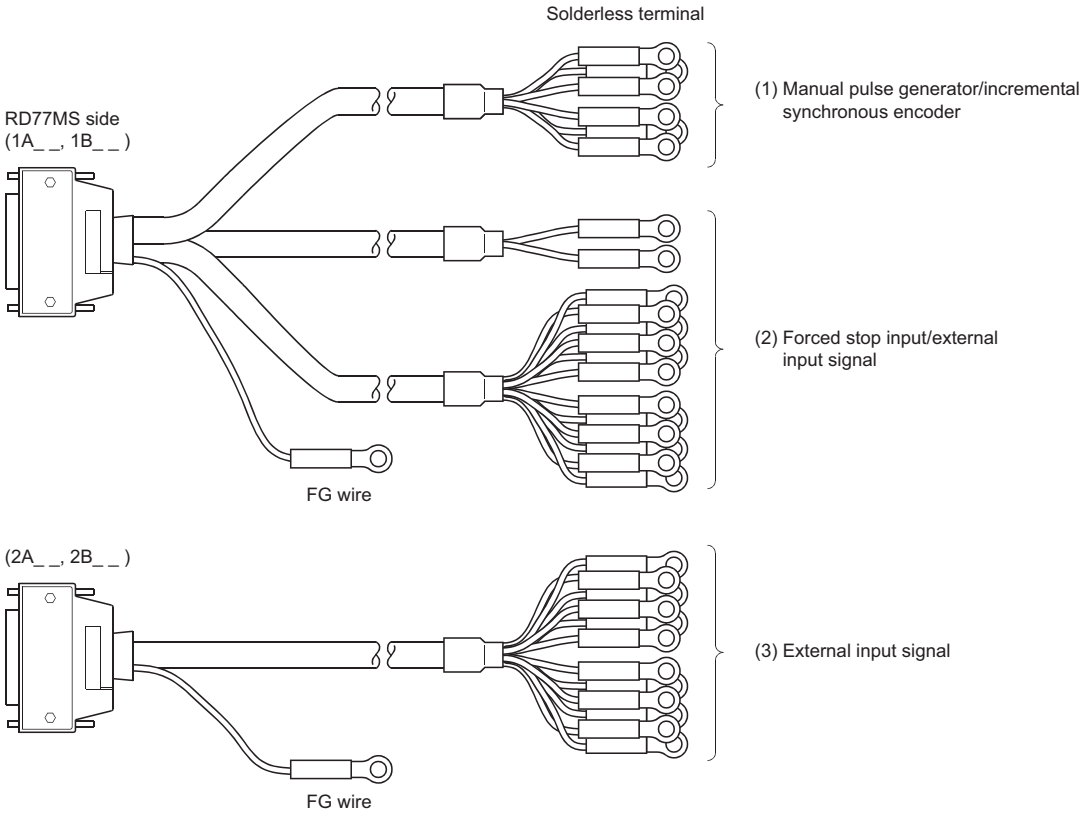
Model name:
FCN-363T-T005/H

- Contact for the specialized tool

Fujitsu component LTD.: http://www.fcl.fujitsu.com/

External input signal cable

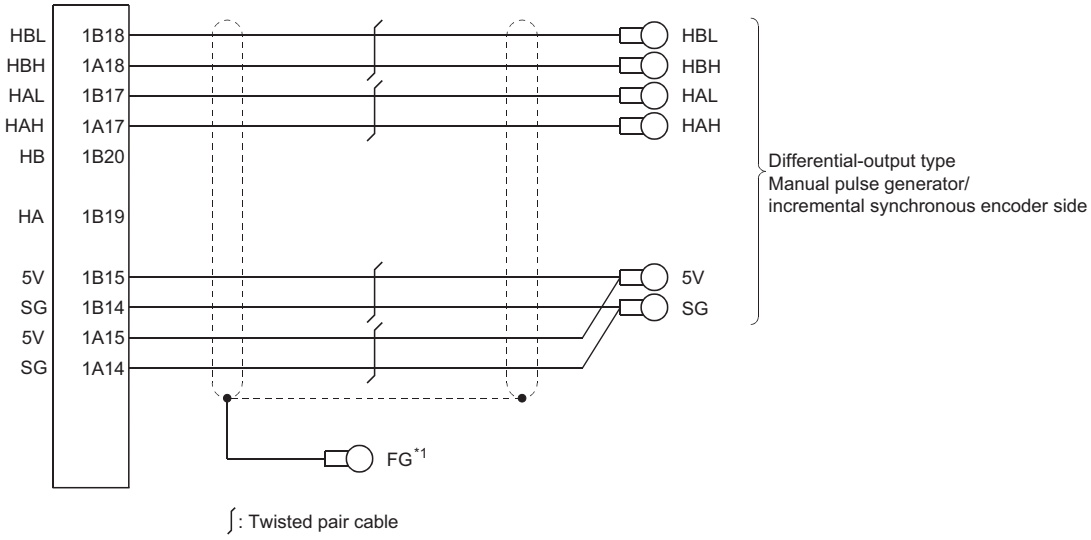
The external input signal cable is not prepared as an option. Fabricate the cable on the customer side.
Make the cable as shown in the following connection diagram.



Manual pulse generator/incremental synchronous encoder

■Differential-output type

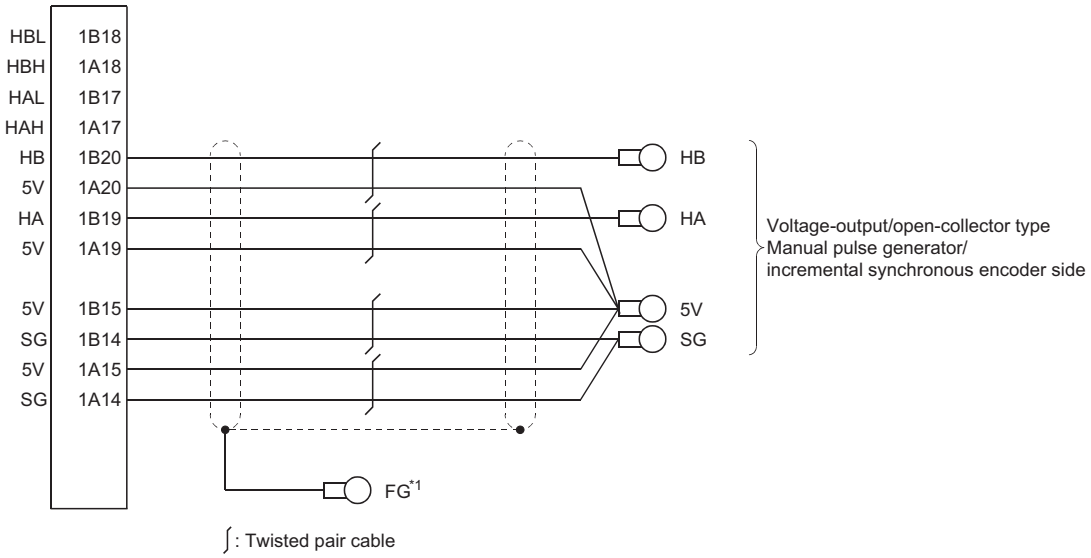
Make the cable within 30 m (98.43 ft.).



*1 Ground FG terminal on the used equipment side. Also, connect it to the shell of connector side.

■Voltage-output/Open-collector type

Make the cable within 10 m (32.81 ft.).

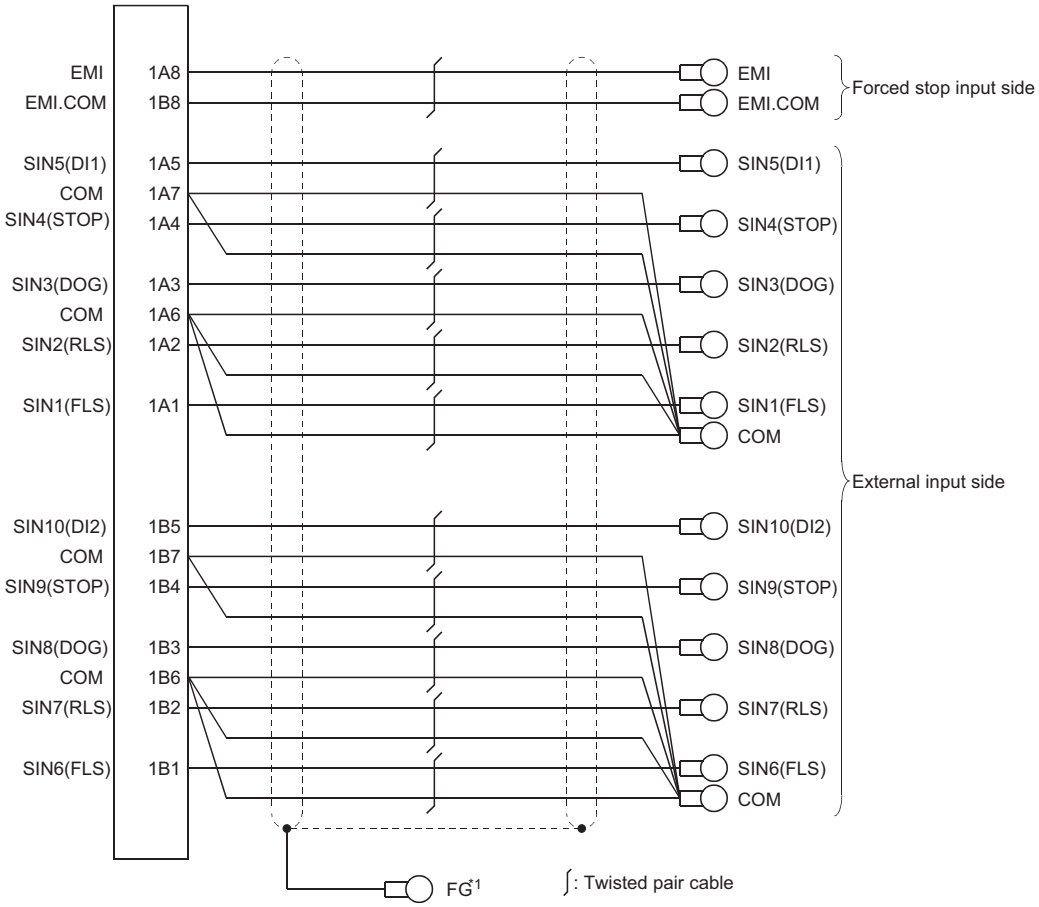


*1 Ground FG terminal on the used equipment side. Also, connect it to the shell of connector side.

Forced stop input/ External input signal

The following connection diagram shows an example using the assignment below. The assignment can be changed arbitrarily.

Input signal	External input signal
SIN1	FLS
SIN2	RLS
SIN3	DOG
SIN4	STOP
SIN5	DI1
SIN6	FLS
SIN7	RLS
SIN8	DOG
SIN9	STOP
SIN10	DI2

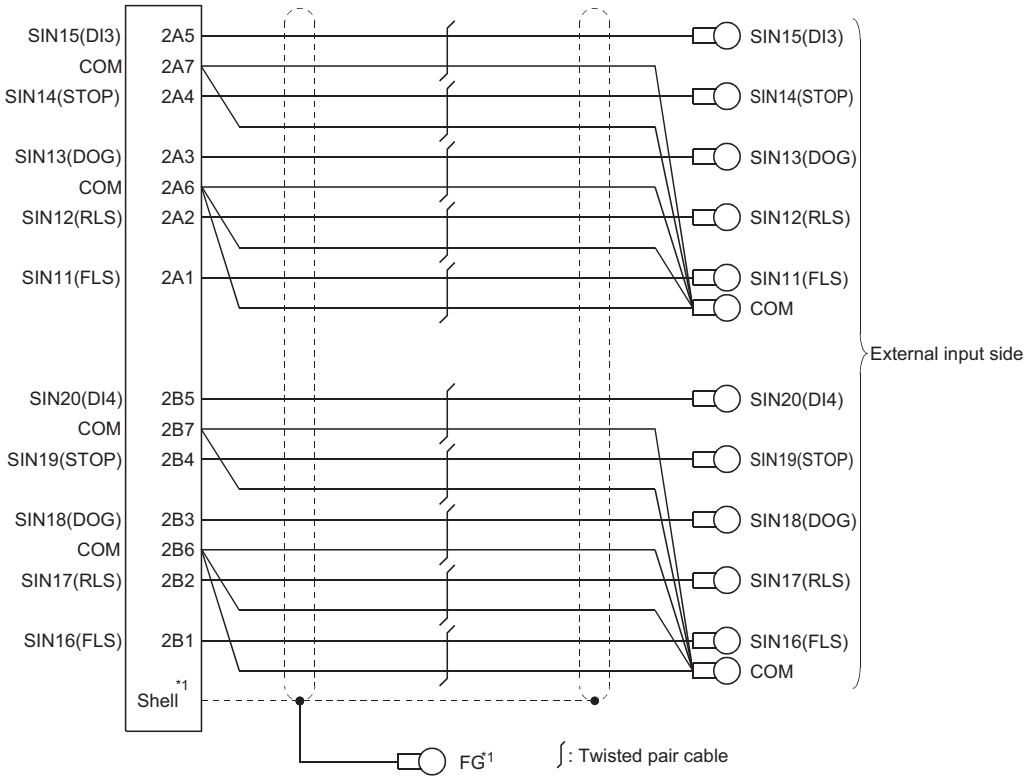


*1 Ground FG terminal on the used equipment side. Also, connect it to the shell of connector side.

External input signal

The following connection diagram shows an example using the assignment below. The assignment can be changed arbitrarily.

Input signal	External input signal
SIN11	FLS
SIN12	RLS
SIN13	DOG
SIN14	STOP
SIN15	DI3
SIN16	FLS
SIN17	RLS
SIN18	DOG
SIN19	STOP
SIN20	DI4

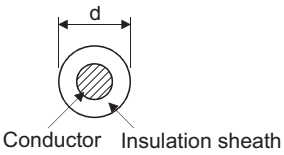


*1 Ground FG terminal on the used equipment side. Also, connect it to the shell of connector side.

• The following table indicates the external input wiring connector cables. Make selection according to your operating conditions.

Wire model	Core size [mm^2]	Number of cores	Characteristics of one core			Finish OD [mm]*2
			Structure [Number of wires/mm]	Conductor resistance [Ω/km]	Insulating sheath OD d [mm]*1	
17/0.16 1P SRV-SV(2464)-K	0.3	2 (1 pairs)	17/0.16	57.5	0.77	5.3
17/0.16 4P SRV-SV(2464)-K	0.3	8 (4 pairs)	17/0.16	57.5	0.77	7.6
17/0.16 10P SRV-SV(2464)-K	0.3	20 (10 pairs)	17/0.16	57.5	0.77	10.0

*1 d is as shown below.



*2 Standard OD. Max. OD is about 10% larger.

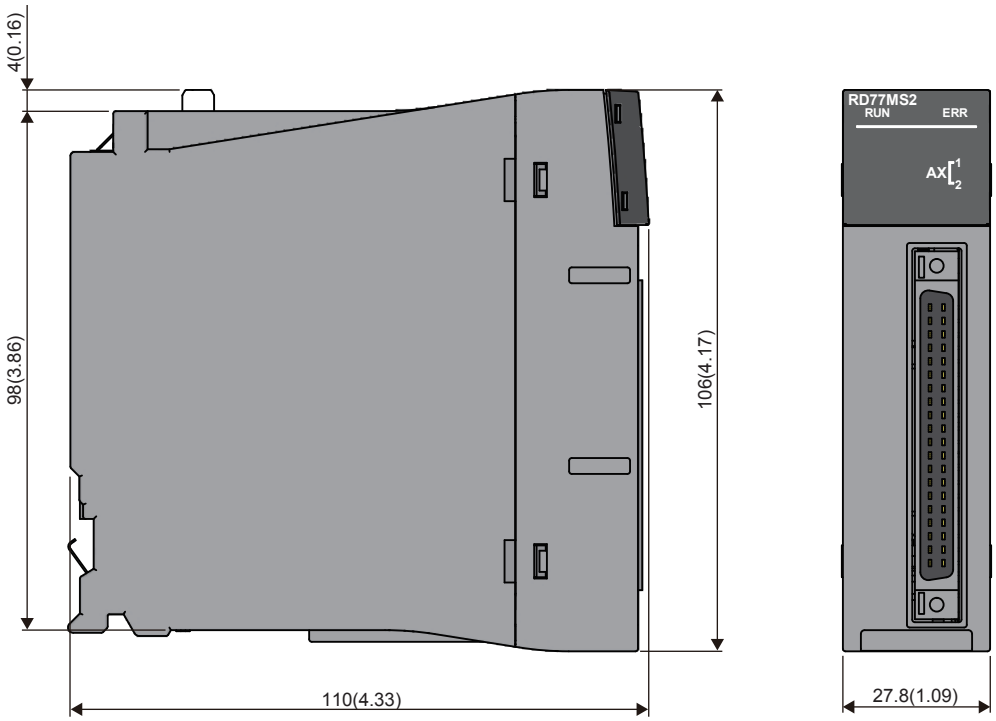
⚠ CAUTION

• When fabricating the cable, do not make incorrect connection. Wrong connection will cause runaway or explosion.

Appendix 3 External Dimensions

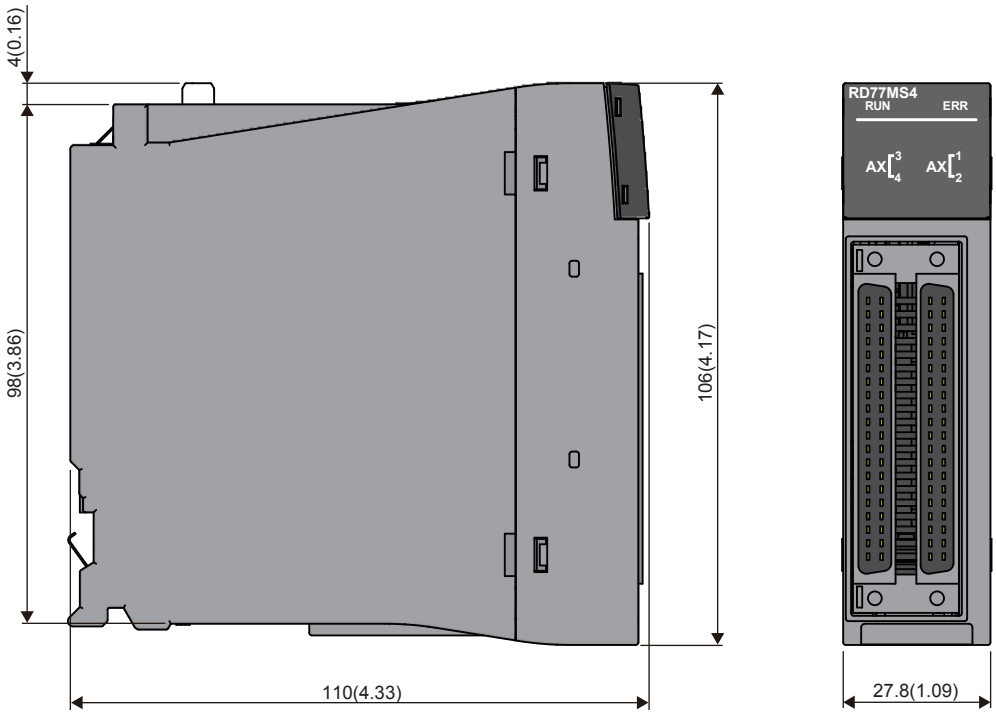
RD77MS2

[Unit: mm(inch)]



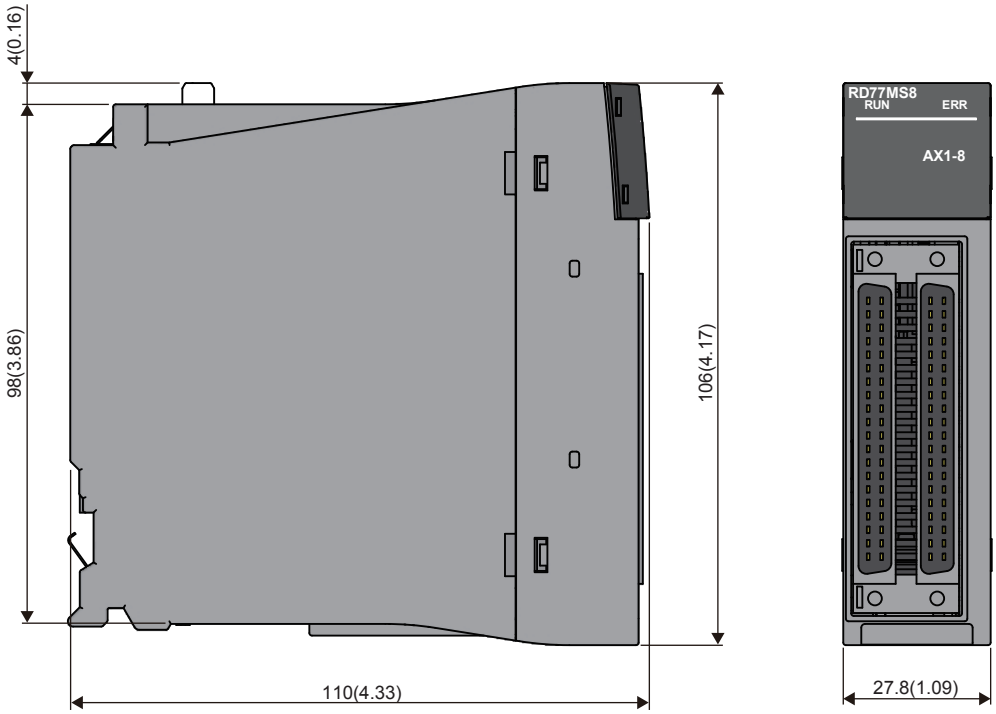
RD77MS4

[Unit: mm(inch)]



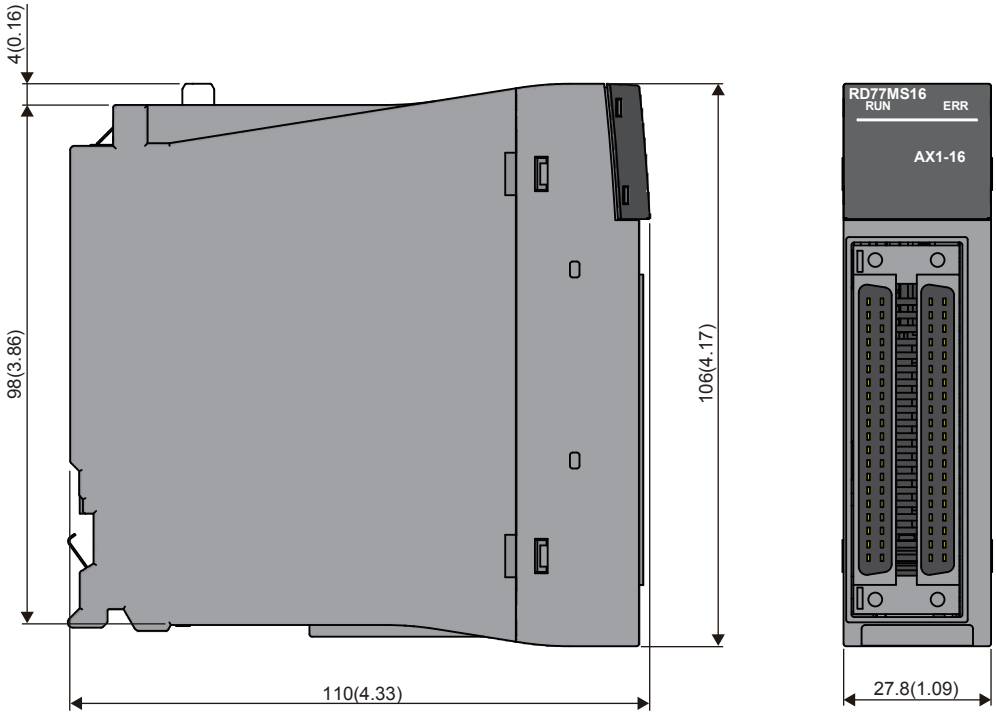
RD77MS8

[Unit: mm(inch)]



RD77MS16

[Unit: mm(inch)]



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REVISIONS

* The manual number is given on the bottom left of the back cover.

Revision date	*Manual number	Description
June 2014	IB(NA)-0300245-A	First edition

Japanese manual number: IB-0300244-A

WARRANTY

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company.

However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place. Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.

(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.

1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
2. Failure caused by unapproved modifications, etc., to the product by the user.
3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.
6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
7. Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.

(2) Product supply (including repair parts) is not available after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation of damages caused by any cause found not to be the responsibility of Mitsubishi, loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products, special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products, replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

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IB(NA)-0300245-A(1406)MEE
MODEL: RD77-U-S-E
MODEL CODE: 1XB012

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